THE IMPACT OF STREET BEGGING ON THE MOVEMENT AND SAFETY OF PEDESTRIANS: THE CASE OF MEGENAGNA, ADDIS ABABA

Fana Berhane Abraha

A Thesis Submitted to the Department of Architecture and Urban Planning and Design School of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's in urban planning and design

Office of Graduate Studies
Adama Science and Technology University

June,2024
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I, the advisor of the thesis entitled "**The Impact of Street Begging on the Movement and Safety of Pedestrians: The Case of Megenagna, Addis Ababa**" and developed by **Fana Berhane Abraha** hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis. Dr. Sileshi Azagew (Ph.D.)

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DECLARATION

I hereby declare that this Master Thesis entitled "**The Impact of street begging on the Movement and Safety of Pedestrians: The Case of Megenagna, Addis Ababa**" is my original work. That is, it has not been submitted for the award of any academic degree, diploma, or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

Fana Berhane Abraha	_____	19/06/2024
Name of student	Signature	Date

RECOMMENDATION

I/we, the advisor(s) of this thesis, hereby certify that I/we have read the revised version of the thesis entitled "**The Impact of street begging on the Movement and Safety of Pedestrians: The Case of Megenagna, Addis Ababa**" prepared under my/our guidance by **Fana Berhane Abraha** submitted in partial fulfillment of the requirements for the degree of Masters of Science in Urban Planning and Design. Therefore, I/we recommend the submission of a revised version of the thesis to the department following the applicable procedures.

Sileshi Azagew (Ph.D.)	_____	19/06/2024
Major Advisor/Supervisor	Signature	Date

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ABSTRACT

Begging on the street sidewalks of urban centers is one of the age-old activities and possibly occupations of society's most vulnerable members, particularly in developing countries. Even if sidewalks are the vital components of urban infrastructure designed to facilitate safe pedestrian movement, street begging has grown to be a serious problem in many cities weakening pedestrian safety and mobility. This research investigated the impact of street begging on the movement and safety of pedestrians on the sidewalks of Addis Ababa, particularly at Megenagna corridors. The study used both quantitative and qualitative data types where surveys and questionnaires were used to identify safety concerns and observations were conducted to record the time-delayed, and movement patterns of street begging incidents. Descriptive and statistical analysis techniques were used to examine pedestrian movement patterns influenced by street beggars, utilizing MS Excel for data visualization, and HCM modeling for scoring congestion levels. The result of the study showed how street begging influenced movements in four sidewalk segments, the underbridge sidewalk of the roundabout, the bridge sidewalk, and the road leading to Shola and Bole, with their designated names as A, B, C, and D respectively. It reveals decreased walking speeds and significant lateral shifts in response to begging interventions across all segments, particularly at Segment C, where the wider lateral positions of 1.72 meters raise concerns about pedestrian safety. Regarding congestion, segment A maintained moderate congestion (Grade C with a score of 8.66), Segment B slightly increased (Grade D,10.7), Segment C significantly rose (Grade E,15.3), and Segment D minimally changed. Predominant concerns of safety included physical safety, environmental cleanliness, emotional well-being, traffic obstruction, and discomfort due to interactions with beggars, necessitating targeted interventions from stakeholders to ensure safety on sidewalks for all pedestrians. Long-term interventions like economic empowerment programs, enacting comprehensive anti-begging legislation, and integrating various elements such as sidewalks, urban design principles, and road safety measures into a unified strategy are highly recommended to improve sidewalk safety and overall urban mobility.

Keywords: Street begging, Safety, Pedestrian, Megenagna, Addis Ababa

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LIST OF ACRONYMS AND ABBREVIATIONS

HCM	Highway Capacity Manual
MOLSA	Ministry of Labor and Social Affairs
NHTSA	National Highway Traffic Safety Administration
PFM	Pedestrian Flow per minute
PLOS	Pedestrian Level of Service
TPMO	Transport Programs Management Office
UNEP	United Nations Environment Programme
US	United States
WHO	World Health Organization
D1	Direction 1
D2	Direction 2

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Begging on the street sidewalks of urban centers is one of the age-long activities and perhaps occupations of the highly vulnerable, poverty-ridden individuals in society, particularly in developing countries. Research from a variety of academics has shown that begging is a global urban issue and not just a problem in developing nations (Zunaira, 2019). The Oxford Dictionary defines "beg" as merely asking for something as a present or as a charitable donation, such as food, clothing, or money (Oxford, 2016). While pedestrians traverse sidewalks, it is known that beggars utilize these walkways to solicit alms from those passing by (Sahani & Rima, 2017).

Begging is often seen because of poverty and destitution. It is accepted to obtain from others what one is unable to obtain for oneself. It is a request to the rest of society to help oneself out of misery and poverty. In this regard, MOLSA (2002) defined begging as a method for earning a living from other sectors of society by using age, health, and economic conditions to gain sympathy. Street begging is a phenomenon that can be observed across different cultures and societies around the world. It is a practice wherein individuals, often facing extreme poverty or social exclusion, seek monetary or material assistance from others (Musibau, 2013).

Street begging has been a serious phenomenon for centuries, tracing back to ancient civilizations where individuals unable to support themselves due to age, disability, or economic hardship sought alms in public spaces (Hannah & Kirby, 2021). In medieval Europe, begging was institutionalized, with the Church often sanctioning and organizing charitable efforts to support the indigent. The Industrial Revolution marked a significant shift, as rapid urbanization and economic changes displaced many rural populations, leading to a noticeable increase in urban begging. Throughout the 20th century, social safety nets and welfare programs in developed nations somewhat reduced the visibility of street begging. However, in many developing countries, rapid urbanization, economic disparity, and inadequate social support systems have continued (Baiocchi et al., 2019).

It is well known that sidewalks are essential for giving pedestrians safe and effective places to go in urban settings. They are vital components of urban infrastructure designed to facilitate safe pedestrian movement (Nardos Abebe, 2020). However, street begging has grown to be a serious problem in many cities across the world, weakening pedestrian safety and mobility (Zunaira, 2019). Street begging activities occupy space on sidewalks, leading to limited walking areas, a lack of safety, walking delays because of congestion, and a decline in the pedestrian level of service (Sahani & Rima, 2017).

Addis Ababa, as one of the fastest-growing cities in Africa, faces numerous urban challenges (Samson, 2012). The city exemplifies the larger issues confronting many urban centers and is dealing with a rapid urbanization rate, unbalanced economic development, and a significant population inflow from rural areas, all of which led to high levels of poverty and unemployment. Street begging is deeply embedded in a complex interplay of socioeconomic factors and urban challenges in Addis Ababa, Ethiopia. Street begging has emerged as one such challenge, impacting the daily lives of its residents (Samson, 2012).

This research aimed to examine the specific challenges posed by street begging on pedestrians in Addis Ababa while analyzing the impact on the movement and safety of pedestrians. This paper studied the impact of street begging practices on pedestrians using sidewalks. Understanding the complexities of this problem and developing effective solutions is crucial for creating a city environment that prioritizes the well-being and convenience of its residents.

1.2 Statement of the Problem

Nowadays, in cities, particularly Addis Ababa, poverty and societal changes caused by urbanization have resulted in more significant and pressing social problems, the most serious and visible of which is street begging (MOLSA, 2002). The streets of Addis Ababa, Ethiopia, echo the complex interplay of urban life, where the prevalence of street begging has emerged as a prominent challenge affecting the movement and safety of pedestrians on sidewalks (Demewozu & Woubishet, 2005).

The city's sidewalks, which should ideally provide comfortable walking spaces, are increasingly crowded due to the presence of beggars. Consequently, pedestrians find it more difficult to traverse the city safely and efficiently (Demewozu, 2005). Sidewalks, designed to facilitate safe and efficient pedestrian flow become spaces of negotiation between beggars and passersby leading to limited walking areas, a lack of safety and walking delays because of congestion, and a decline in the pedestrian level of service. This can lead to inefficiencies in urban mobility, affecting not only pedestrians but also the economic activities that rely on the smooth flow of people. Businesses may experience reduced foot traffic, which can impact their sales and revenue. It could also force pedestrians to share roadways with vehicles, thereby increasing the risk of pedestrian accidents (Sahani & Rima, 2017).

According to the US Embassy,(2016), Addis Ababa is becoming Africa's crime capital. In Addis Ababa, there has been an increase in purse snatching, pickpocketing, and harassment since 2011. There have been reports of people being mugged and assaulted in certain locations, leaving pedestrians feeling unsafe and deterred from walking in these areas. Besides pedestrian walkways being blocked by roadside the most significant impediment to pedestrian traffic flow is street beggars (Sahani & Rima, 2017). The vulnerability of pedestrians to such incidents increases when they are distracted or slowed down due to the presence of beggars. This poses a serious threat to the well-being of individuals using the sidewalks (Teweldeberhan, 2011).

Though there are various research studies on related urban phenomena and social problems, there is a glaring research gap in the issue of how street begging, in particular, affects urban pedestrians 'mobility and safety. Many available papers take on more general aspects of urban

life and don't pay much attention to the complex exchanges and subtle implications that arise as pedestrians share with street beggars the spaces they pass through.

This problem calls for a thorough investigation into the extent of the issue, its underlying causes, and the consequences it has on pedestrian mobility and safety. Understanding the impact of street begging on the movement and safety of pedestrians in Addis Ababa is crucial to develop effective strategies and interventions that can address this issue and improve the overall pedestrian experience in the city (Daniel Molla, 2017). Consequently, this study seeks to unravel the implications of street begging on the movement and safety of pedestrians on sidewalks, contributing to a more inclusive urban environment.

1.3 Objective of the Study

1.3.1 General Objective

The general objective of the study is to investigate the impact of street begging on the movement and safety of pedestrians on the sidewalks of Addis Ababa.

1.3.2 Specific Objectives

1. To investigate the impact of street begging on the flow of pedestrian movement.

2. To evaluate the extent of congestion caused by street begging on sidewalks.

3. To assess the current safety problems faced by pedestrians on sidewalks.

1.4 Research Questions

1. How does the presence of street begging impact the flow of pedestrian movements on the walking speed and lateral position on sidewalks?

2. What is the extent of congestion caused by street begging on the sidewalks?

3. What are the safety problems faced by pedestrians on the sidewalks of Addis Ababa?

1.5 Significance of the Study

The significance of this study lies in its potential to mitigate the adverse effects of street begging on pedestrian movement and safety. By bridging the gap between the lived experiences of those engaged in begging and the daily realities of pedestrians, the research aspired to contribute to

the creation of inclusive, safe, and aesthetically pleasing urban environments. This study explored the community's social fabric, bringing light on how people adapt to or are affected by the presence of street beggars in their daily lives. The findings of the study can be used to inform community engagement strategies, foster a deeper awareness of local needs and concerns, and guide the development of socially sensitive policies.

Urban planners can use the findings to refine and optimize urban infrastructure, particularly sidewalks. Understanding how street begging affects pedestrian movement allows planners to create spaces that accommodate the various dynamics of urban life. The findings can help guide decision-makers about pedestrian flow and the implementation of measures to improve personal security and reduce accidents. By addressing these issues, urban planners can help to create inclusive, accessible, and safe spaces that meet the needs of all citizens, resulting in a more vibrant and resilient urban landscape in Addis Ababa.

1.6 Scope of the Study

The spatial scope of the study covers the sidewalks of Megenagna along the bridge, the under-bridge passageways of the roundabout, and the sidewalks of the road leading to Bole and Shola. These areas are selected based on having increased pedestrian flow, traffic congestion, and increased crime rates. Thematically, the study focused on measuring the time delay, the lateral position, and the level of congestion and assessed the safety concerns of pedestrians.

1.7 Limitations of the Study

The main limitation of the study was the absence of available references and literature on street begging and its influence on pedestrians along sidewalks in an Ethiopian setting. Interacting with participants and respondents in a crowded street was also challenging. Due to its divergence from the focus, the study did not explore the social dimension of street begging.

1.8 Definition of Key Terms

Walking Speed: Walking speed refers to the rate at which a pedestrian moves along a pathway, measured in meters per second (m/s). It is calculated using the formula $V=D/t$, where V is the walking speed, D is the distance covered, and t is the time taken to cover that distance.

Lateral Position: Lateral position indicates the side-to-side deviation of a pedestrian from their intended path or desired trajectory. It is measured from the desired trajectory to the end of the forced trajectory due to obstacles or other factors, in meters (m).

Trajectory: Pedestrian trajectory refers to the actual path or route that a pedestrian follows while walking through an environment.

Desired Trajectory: The desired trajectory is the intended straight path that pedestrians aim to follow while walking.

Baseline Observation: Baseline observation refers to the initial measurement and recording of pedestrian behaviors and movements in a controlled environment of external obstacles without begging activities. This serves as a reference point to compare with a scenario of begging instances.

Begging Intervention: Begging intervention involves the introduction of beggars into a pedestrian environment to study their impact on walking speed and lateral position. This is compared against baseline observations to determine any significant changes.

Safety: safety in the context of pedestrian studies generally refers to the condition of being protected from or unlikely to cause danger, risk, or injury while walking.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter gives a general theoretical framework about street begging and its impact on pedestrian safety and movement. It also presents facts of previous findings, ambiguity, and arguments about the concept that has been researched.

2.2 Theoretical literature review

This part contains; published journals, books, documents, research papers, and different sources for understanding the idea of street begging, its cause and consequence on pedestrians using sidewalks, its impact on walkers' safety, and pedestrian traffic analysis and designs.

2.2.1 Begging

According to Nagpaul, (2003), a beggar is defined as "any person of European extraction found asking for alms when he has sufficient means of subsistence or asking for alms in a threatening or abusive manner." insolent manner or continuing to ask for alms from any person after being told to stop." Begging is commonly perceived because of poverty and deprivation. It is customary to obtain from others what one cannot obtain for oneself. It is a request to the rest of society to help oneself out of poverty and misery. In this regard, MOLSA, (2002) defined begging as a method of obtaining a living from other sectors of society by using age, health, and economic conditions to gain sympathy. According to Nagpaul, (2003), beggars are mobile charity seekers who can easily be identified by the way they live and earn the money necessary for survival; the majority of whom are homeless and live in the open or in impoverished huts.

The practice of begging is an issue that affects the entire nation and cannot be attributed to one part of the country. It is a contemporary problem that occurs within urban spaces irrespective of the country it involves Nagpaul, (2003). Even though begging exists worldwide, most countries located in the first world do not face such a challenge. In most urban cities, there are street beggars in filling stations, restaurants, banks, supermarkets, mosques, and churches among others. Some of the vices related to street begging include theft, thuggery, and vandalism (Usmanu, 2012)(Kabiru K & Salami, 2013).

However, the problems of beggary in Ethiopia are not being addressed by the government or the public, which is why its prevalence and extent are doubling regularly. Begging is a business that requires dedication, competitiveness, tact, and alertness. The fit will survive, while the inexperienced and uncompetitive will perish in the social competition for the scarce resource, alms (Demewozu & Woubishet, 2005).

2.2.2 Causes and categories of beggars

Begging cannot be attributed to a single cause. Neil Anderson, (2022) claims that the conditions and motivations that lead to people becoming homeless in general, and beggars in particular, can be divided into five categories: (a) Unemployment and seasonal work, (b) industry misfits whether due to physical handicaps, mental deficiency, occupational diseases, or a lack of vocational training c) Personal challenges such as intellectual limitations, inherent weaknesses, or self-centeredness that cause friction with established authorities in the industry, society, and government, d) Life crises such as family disputes, misconduct, and criminal behavior that alienate an individual from their home and community, severing normal social connections, (e) racial or national discrimination occurs when a person's race, nationality, or social class is used as a factor in adverse employment selection; and (f) wanderlust-the desire for new experiences, excitement, and adventure (Neil Anderson, 2022).

According to the MOLSA, (2002) the report, the main reasons for most of the beggars' reliance on the practice are disability, destitution in old age, unemployment, and 26 underemployments. However, most people report a variety of other reasons, such as a lack of money for transportation after a visit to relatives or after medical treatment; a lack of money for medical treatment; long-term detention; and a loss of money because of theft or robbery.

Nagpaul, (2003), provides an exhaustive list of the causes of begging. The causes were discovered during a research survey conducted in Greater Bombay. Overpopulation in the region, with consequent pressure on land and inability of land to support the people; debts; famines, floods, and epidemics which weaken or impose difficulties on the community; family breakdowns; emotional and economic disabilities imposed on a man or a woman after desertion; chronic and harmful diseases; physical and mental disabilities; absences and criminal activity; inability to find work; unwillingness to work; religious bias and vows and binding one to the

mendicant order; anti-social attitudes and child lifting; lack of facilities employment training; lack of institutions providing for the welfare of the unattached, abandoned, and disabled; lack of social security measures and absence of social responsibility The obvious attractions of city life, paired with the possibility of easy and ticket-free railway travel, and the general outlook on age that leads one to believe in fate.

Table 2.1 Percentage distribution of beggars by their causes

Variable	Category	Response		Percent of Cases
		N	Percent	
Causes of begging	Poverty	122	45.4%	64.9%
	Homelessness	14	5.2%	7.4%
	Loss of Prpoerty	3	1.1%	1.6%
	Unemployment	26	9.7%	13.8%
	Health Problems	47	17.5%	25.0%
	Death of both Parents	8	3.0%	4.3%
	Physical disability	30	11.2%	16.0%
	Lack of old age security	3	1.1%	1.6%
	Divorce	1	0.4%	0.5%
	Lack of caring relatives	11	4.1%	5.9%
	Considering begging as a job	4	1.5%	2.1%
	Total	269	100.0%	143.1%

Source 1 Field Survey, 2020

Beggars may be grouped into the following eight categories:

Able-bodied- Able-bodied beggars make up most of the beggar population and come to beg due to poverty and unemployment before becoming professionals. Because of the poor, they are

given free food at religious institutions. According to (Osagbemi, 2001), able-bodied beggars are the ones who are lazy and wander around the city. They never bother looking for work; instead, they harass and cajole the public into giving them alms.

Religious- people are known to the beggars that helping the poor is an advantage for any religious people. When devotees visit religious sites for worship, beggars do not usually pray for alms. As a result, when devotees return from religious sites, beggars crowd around them and sing aloud for alms. Religious mendicants hide behind the veil of religious faith. They are mostly seen on temple grounds. During festivals, they also travel extensively from temple to temple (Jelili, 2006).

Physically handicapped- Throughout history and around the world, people with disabilities have begged. They have requested money and other forms of charity. The blind, deaf-mute, crippled, and deformed are examples of this type of beggar (Cuff et al., 2015).

Mentally Handicapped- Beggars of this type include the weak-minded and those suffering from mental illnesses. The weak-minded are considered microcephalic (having an abnormally small skull), hydrocephalic (having an enlarged skull and often described as having water on the brain), paralytic, or traumatic. There are many beggars with mental disorders who just rot on the streets. When such beggars sit in one place for several days running, they urinate and defecate in the same spot if they are not covered with lice, germs, mosquitoes, flies, and other vermin too numerous to count and even when a crow comes and starts pecking at their heads no one paying any attention (Okoli, 2003).

Diseased- Aside from the physically and mentally disabled, there are also persistent beggars and those suffering from various organic problems or organ weaknesses. They are beggars suffering from acute stages of venereal diseases, leprosy, epilepsy, tuberculosis, and various skin diseases, and may be more offensive than the sight of the mentally disturbed beggar (Okoli, 2003).

Weak- Those suffering from malnutrition fall into this category of beggars. Most of these beggars only eat twice a day and take nothing else as a supplement, such as milk or fruit, which leaves them with no energy to do any work, which is why they are begging (Kennedy, 2001).

Old- The falling apart of the joint family system has made the lives of the elderly insecure. The value system has also changed dramatically, with young people refusing to shoulder the responsibility of caring for elderly parents who are unwanted in their own homes. Most of these people resort to begging, with their main complaints being their inability to work due to their old age and the neglect of their children (Cuff et al., 2015).

Child- A child beggar can work as a paid or unpaid assistant to an adult beggar. Begging would not be a profitable business if there were no children to attract the attention of the customer. As a result, the beggar child is the most important asset in the trade, and as such, it is sold, bartered, or mortgaged. Children are easily able to elicit sympathy from the public. As a result, many children are brought into this profession, as it is considered an item in which a mother who was separated from her husband used her children for begging (Kennedy, 2001).

Others- Eunuchs (also known as 'hijras') are people who live on the outskirts of society and have very low social status. These individuals have few possibilities for employment. Many make a living by performing at ceremonies, begging, and prostitution; these are occupations also recorded for eunuchs in pre-modern times. They are frequently seen demanding money from people on the streets, trains, and other public places. If they are refused, they may use obscene gestures, profane language, and even sexual advances to try to embarrass the man into giving money (Cuff et al., 2015).

Addicts- Addicts used to beg for money to buy drugs. Many beggars are young male drug addicts (Kennedy, 2001).

Beggars use a variety of methods to attract attention, including blocking a pedestrian's path by pressing their hand or a cup out in front of them. Carrying a sign or keeping out a cup on a city sidewalk, threatening, insulting, and touching passersby to frighten them into giving money are all methods. In general, even though begging is done passively, an act of begging in one context may not be frightening, but the same behavior in another may be (Fawole et al., 2011).

2.2.3 Street begging on sidewalks

Street begging on sidewalks is a frequent sight in many cities. It involves people, many of them in difficult circumstances, seeking financial help from passers-by (Kongoley, 2017). These beggars can be seen sitting or standing on the sides of busy streets holding signs or containers

for collecting donations. The reasons for street begging are many. Most street beggars are homeless because they have no home and are poor or unemployed. Some may suffer from physical disabilities and cannot find work. Others suffer psychological problems which make them unable to maintain a regular income source. Some may truly be in need, while others make begging into a career. The problem of begging on sidewalks is an intricate and delicate issue, raising questions about social welfare, generosity toward others, and the utility of support networks (Hayu, 2018).

2.2.4 Prevalence of Street Begging in Addis Ababa

Addis Ababa, the vibrant and bustling capital of Ethiopia, grapples with the complex issue of street begging, a phenomenon that is visibly woven into the fabric of the city's urban landscape. The prevalence of street begging is evident in various neighborhoods, markets, and busy intersections, where individuals, often in vulnerable circumstances, seek assistance from passersby. The reasons behind the prevalence of street begging are multifaceted, including economic hardships, unemployment, and social challenges. Many individuals engaged in begging may be marginalized, facing limited access to education and employment opportunities (Victor & David, 2011).

Additionally, the city's rapid urbanization and population growth contribute to the visibility of street begging. The phenomenon not only highlights socio-economic disparities but also raises questions about the effectiveness of existing social support systems. In navigating the prevalence of street begging, Addis Ababa faces the intricate task of addressing the root causes while simultaneously providing support and alternative pathways for those seeking assistance. Efforts to understand and mitigate the prevalence of street begging require a comprehensive approach that combines social interventions, economic empowerment initiatives, and community engagement strategies to foster inclusivity and address the underlying challenges faced by vulnerable individuals in the city (Abebe & Tatek, 2009).

2.2.5 Safety, comfort, and convenience while walking

2.2.5.1 Pedestrian Safety

Under various conditions, theories concerning pedestrians and issues such as safety, convenience, and comfort have been developed. According to the National Highway Traffic

Safety Administration, 5,977 pedestrians are killed in motor vehicle accidents in the United States each year. Even though this number has decreased from the previous year, it demonstrates that there are safety concerns regarding pedestrian road users. The death toll of pedestrians in Addis Ababa was listed as 82% of all recorded deaths in 2017 in the 2017 TPMO Annual Report. Most countries around the world are concerned about pedestrian safety. Statistically, developing countries have more pedestrian safety problems than developed countries. In most pedestrian-motor vehicle accidents, the walker is killed. To provide pedestrian safety solutions, all factors affecting pedestrian safety must be considered (NHTSA, 2017).

The main factors affecting pedestrian safety, according to Nega Dagnaw, (2019) and his study of sidewalk safety as it relates to crime, are the types of building frontage, lighting, and mixing different purposes for the sidewalk. According to studies, people who live in areas with good pedestrian transportation systems and lower crime rates are more likely to walk (Fawole et al., 2011).

Numerous articles link safety to walking rate. Pedestrian activity correlates with the level of personal safety in each area, according to Nega Dagnaw, (2019). Fawole et al., (2011)defines safety as "victims and the fear of victimization." A pedestrian-friendly sidewalk environment that is free of personal attacks encourages pedestrian use. The goal of safety is to be free of both physical and emotional pain (Kerebih, 2014).

2.2.5.2 Pedestrian Comfort

While walking on a smooth sidewalk with easy access, comfort is relief from harm and problematic situations Nega Dagnaw, (2019). A barrier-free sidewalk that exudes a friendly environment will provide pedestrians with a high level of comfort. Smooth sidewalks with easy access and friendly neighborhoods provide pedestrians with a high level of comfort. Elements of a sidewalk can be measured, as can the satisfaction provided by the elements, to ensure pedestrian comfort and convenience. Sidewalks are intended to allow pedestrians to move freely according to their needs (Nega, 2019). The satisfaction provided by the pedestrian's interaction with the environment during a walk leads to comfort (Fawole et al., 2011). According to Kerebih Asres, (2014), the following factors influence pedestrian comfort while walking on sidewalks:

pavement quality and width, absence/presence of obstacles, topography, noise pollution, cleanliness, landscaping, weather conditions, route continuity, and finally, route directness.

2.2.5.3 Pedestrian convenience

At negligible cost, sidewalk obstructions mailboxes, telephone booths, newsstands refuse cans, and planters can be relocated to improve pedestrian flow. Less mobile items, such as traffic light standards or fire hydrants, could be moved under normal replacement schedules. Ramped curb cuts provide convenience for handicapped pedestrians in wheelchairs, persons wheeling baby carriages, and others bothered by high curbs. Tactile trails can be built for the blind in buildings and places frequented by the visually impaired (Watson et al., 2003).

Pedestrian amenities include bus shelters, covered arcades, benches, and universal design and access features. Ramped curbs help the elderly, women pushing baby carriages, and people in wheelchairs, and there is plenty of seating and rest areas. Sidewalk widening, multiple building entrances, access to transit or parking garages, subsurface concourse or overhead bridge connections to other buildings or transit facilities, arcades, malls, plazas, pedestrian connectors bisecting long blocks, off-street taxi and bus passenger loading areas, off-street truck berths, restrictions on cross sidewalk freight operations, and traffic signals timed for pedestrians are all examples of pedestrian traffic and circulation improvements (Watson et al., 2003).

2.2.6 Factors affecting pedestrian movement and safety.

2.2.6.1 Increased Congestion on Sidewalks

The available space for individuals to move freely decreases as the number of pedestrians in each area increases. Walking speeds slow as people maneuver through the crowd, attempting to avoid collisions or disruptions (Kweon & Byoung Suk, 2021). The overall flow becomes more erratic, and individuals take longer to travel a specific distance. Congestion reduces the effective width of sidewalks and walkways. Pedestrians may be forced to walk in a single file or navigate around obstacles, slowing overall movement even more. This pathway capacity limitation can be exacerbated in areas with fixed structures such as street furniture, stalls, or narrow sidewalks (Campbel, 2004).

This crowding on the sidewalk heightens the chance of contact between people. The closer proximity can lead to unintended collisions, which may be an inconvenience, or even

dangerous. In addition, the greater friction can cause frustration for pedestrians and make simply walking in congested areas itself an undesirable experience. In congested areas, pedestrian safety becomes a growing concern. They may also be more likely to trip and fall, particularly when walking over uneven surfaces or crowded areas. In addition, congestion may threaten safety by hampering emergency evacuations or responses (Campbel B., 2004).

2.2.6.2 Obstruction of Pedestrian Pathways

Physical obstacles force pedestrians to navigate around or through them, reducing overall flow and walking speed. This can be especially difficult in congested urban areas, where even minor obstructions can disrupt people's smooth movement (Abiy Eguale, 2015). Congestion is exacerbated by obstructions, particularly in high-traffic areas. When pedestrians are forced to slow down or deviate from their intended paths, bottlenecks form, and population density increases in specific areas. Congestion leads to a more stressful and inefficient pedestrian experience. These obstructed routes are dangerous. These obstacles must be avoided. The standard procedure is to step onto the road or jump over uneven surfaces, but this can result in tripping and falling or crashing with another pedestrian. This is especially concerning for the elderly and the disabled (Suminski & Richard R., 2019).

Those who must put up with the obstacles get frustrated and uncomfortable. This can result in adverse impressions of the urban environment and reluctance among people to walk or on pedestrian thoroughfares, instead relying exclusively on other forms of transport. Blocked-off pathways make it hard for the handicapped to get around. People in wheelchairs, the visually impaired, or users of mobility aids may have great problems breaking obstacles. This absence of access is a factor in social alienation and limits these people's autonomy (Corinne Kisner, 2013; Suminski & Richard R., 2019).

2.2.7 Pedestrian walking distances

Walking distances influence plan configuration and serve as a measure of design serviceability. Tolerable distances are a matter of personal taste. The practical limit of human walking distance appears to be related to context and situation rather than human energy, according to pedestrian studies at Port of New York Authority bus terminals. Most people can tolerate a maximum walking distance of 5 to 7 minutes. Rather than energy consumption, the tolerable walking

distance for a given design situation is determined by factors such as the individual's trip purpose, available time, and walking environment. This implies that improving the design environment to reduce negative psychological factors is as important as reducing pedestrian walking distances (Watson et al., 2003).

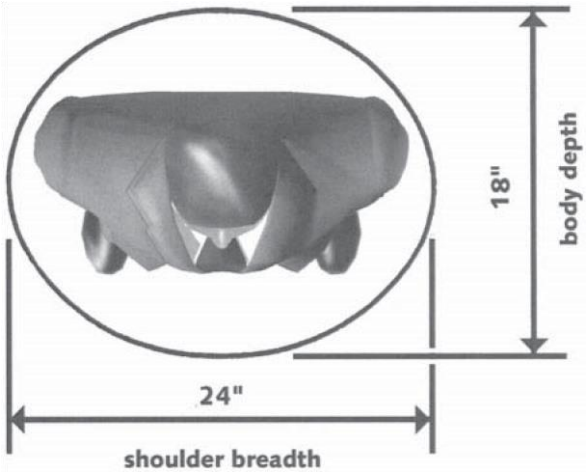

Figure 2.1 Body ellipse assumed for pedestrian design purposes. An ellipse 18 in. by 24

2.2.8 Five pedestrian traffic analysis and design

This section discusses pedestrian traffic volumes and queuing relationships based on average pedestrian area occupancy, providing easily understood measures for design. It presents the analysis and principles used to develop the “Level of Service” Design Standard detailed herewith.

• **Flow:** The number of traffic units passing through a point in a unit of time is referred to as volume. Flow is expressed in pedestrian design as pedestrians per unit width (in feet) of the walkway or stairway per minute, or Pedestrians/Foot/Minute (PFM). The width of the pedestrian way (pedway) is determined by flow, which is the most important traffic characteristic. Inadequate width restricts flow, causing pedestrian discomfort. P has been assigned to a volume (Paul et al., 2024).

• **Speed:** Pedestrian locomotion speed, expressed in distance per unit of time, generally in feet per minute. When related to the design of a pedway section, speed is the average speed of all

pedestrians passing through the section during the design interval. Speed is designated as S (Campisi et al., 2022).

• **Density:** The number of traffic units per unit of area. In pedestrian design, density would be expressed in tenths of a pedestrian per square foot, a difficult unit to visualize. A more manageable unit, the reciprocal of density, or the sq. ft. of area per pedestrian, is used consistently in this article. The reciprocal density has been designated as M, the Pedestrian Area Module (Watson et al., 2003).

• **Headway:** The time and distance separation between traffic units (pedestrians, in the context of this article). For example, a two-second headway is the equivalent of one unit (pedestrian) passing a point each two seconds, or a flow volume of 30 traffic units per minute. Headway has not been commonly referred to in the design of pedestrian facilities, but it has useful applications (Campisi et al., 2022).

• **Queue:** This is defined as one or more traffic units and in this discussion pedestrians who are waiting for service. If the pedestrian areas or service facilities have insufficient capacity, a pedestrian queue will develop. Queue lengths and duration will vary according to traffic flow characteristics. In crowded systems, queues may be generated intermittently, due to random variations in traffic intensity. The flow equation, the classic relationship of traffic design, derived from an analogy to fluid flow in channels, is expressed as follows:

$$\text{Flow Volume} = \text{Average Speed} \times \text{Average Density}$$

$$\text{or,} \quad P = S \times D$$

As mentioned above, the application of the term “density” to pedestrian traffic results in the unwieldy unit of tenths of a pedestrian per square foot, so that the reciprocal of density, sq. ft. area per pedestrian (M), is more useful. The equation for pedestrian flow volume, (P), in pedestrian per foot width of pedway section, per minute, (PFM) is expressed as follows:

$$\text{Ped Volume} = \frac{\text{Average Ped Speed, feet per minute}}{\text{Average Ped Area, sq. ft. per ped.}}$$

$$\text{or,} \quad P = \frac{S}{M}$$

In this formulation, the designer has a clearer concept of relative design quality since the units are easier to understand and manipulate. For example, the next section will show that a nearly normal average walking speed of 250 ft. (76 m) per minute is attained with an approximate average pedestrian area of 25 sq. ft. (2.3 m sq.) people. The simple division of area occupancy into average speed gives an equivalent design volume of 10 pedestrians per foot width of walkway, per minute. Time and distance headways can be determined from flow volumes by assuming a specific pedestrian lane width. For example, if a 3-ft. (.9-m) wide pedestrian lane width has a flow of 10 PFM, as cited above, this is equal to a pedestrian volume per lane of 30 persons per minute, or the equivalent of an average time spacing of two seconds between pedestrians (Paul et al., 2024).

This time spacing is translated into an average distance spacing of about 8 feet between following pedestrians, by multiplying by the 250 ft. (76 m) per minute walking speed (Campisi et al., 2022).

2.2.9 Pedestrian walking speeds

Most people walk at speeds between 0.8 meters per second (m/s) and 1.8 m/s (2.9 kilometers per hour (km/h) and 6.5 km/h). A fi t, healthy adult will generally travel at a mean speed of 1.5 m/s (15th percentile) (NZ Transport Agency., 2009). When unimpeded by crowd density or other traffic frictions, pedestrians may vary their walking speeds over a wide range. Based on these surveys, the average free flow walking speed for all males, females, and the combination of all pedestrians in the surveys, were 270, 254, and 265 ft. (82, 77, and 80 m) per minute, respectively. Average speeds were found to decline with age, but slow and fast walkers were observed in all age groups. Factors such as grade, and the presence of baggage or packages, have been found to have no appreciable effect on free-flow walking speed (Watson et al., 2003).

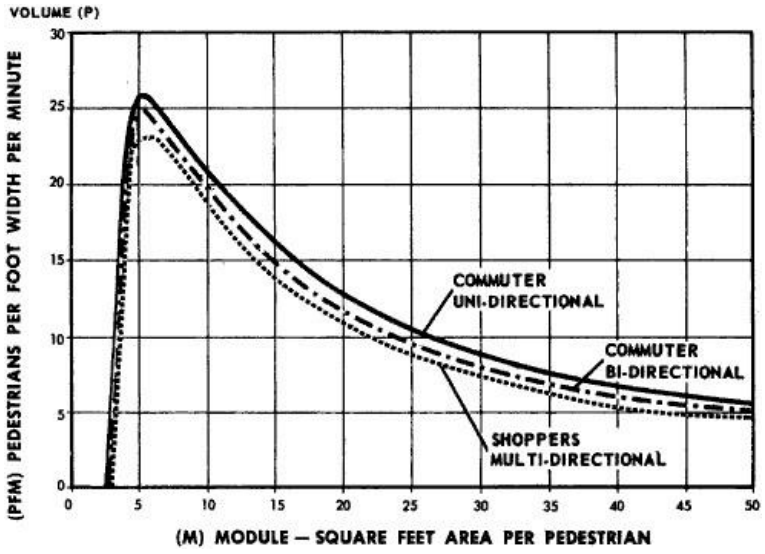

Figure 2.2 Pedestrian flow volume and area occupancy. Data obtained from time-lapse.

The remaining determinant of pedestrian walking speed is traffic density. As traffic density increases, pedestrian speed is decreased, because of the reduction in available clear area for locomotion. Fig. 2.2 shows the effect of increased traffic density, or decreasing area occupancy, on pedestrian walking speeds for one-directional commuter traffic flow. Similar studies of two-directional commuter and multi-directional flows of shoppers resulted in only small variations from this curve, confirming its more general applicability (Paul et al., 2024).

2.2.10 Six Levels of Service Design Standards

The Level of Service (LOS) concept was first developed in traffic engineering to address the realization that designing solely for capacity was inadvertently leading to planned congestion. The Level of Service concept provides a useful standard for the design of pedestrian spaces as well. Pedestrian service standards should, similarly, be based on the freedom to select normal locomotion speed, the ability to bypass slow-moving pedestrians, and the relative ease of cross- and reverse-flow movements at traffic concentrations (Benhadou et al., 2024).

Walkways: Level of Service A

Average Pedestrian Area Occupancy: 35 sq. ft. (3.25 m sq.) per person, or greater.

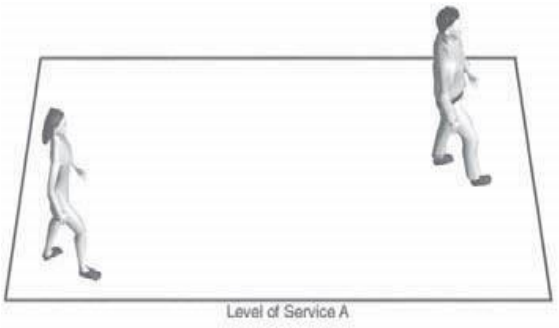

Figure 2.3 Level of service A

Average Flow Volume: 7 PFM (Pedestrian Foot per Minute), or less.

At Walkway Level of Service A, ample space is provided for pedestrians to freely choose their walking speed, overtake slower walkers, and avoid conflicts with others. Designs consistent with this Level of Service would include public buildings or plazas without severe peaking characteristics or space restrictions (Paul et al., 2024).

Walkways: Level of Service B

Average Pedestrian Area Occupancy: 25–35 sq. ft. (2.3–3.25 m sq.) per person.

Average Flow Volume: 7–10 PFM.

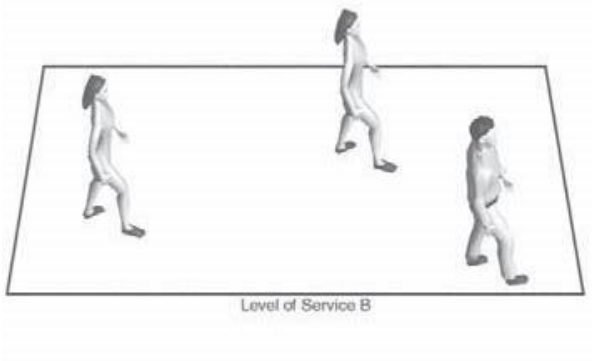

Figure 2.4 Level of service B

At Walkway Level of Service B, sufficient space is available to select normal walking speed and to bypass other pedestrians in primarily one-directional flows. Where reverse directions or pedestrian crossing movements exist, minor conflicts will occur, slightly lowering mean pedestrian speeds and potential volumes (Campisi et al., 2022).

Walkways: Level of Service C

Average Pedestrian Area Occupancy: 15–25 sq. ft. (1.4–2.3 m sq.) per person.

Average Flow Volume: 10–15 PFM.

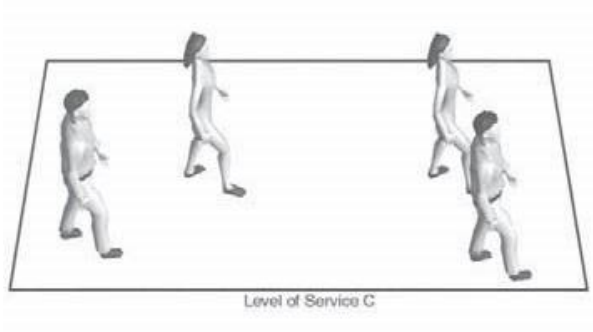

Figure 2.5 Level of service C

At Walkway Level of Service C, the freedom to select the individual walking speed and freely pass other pedestrians is restricted. Where pedestrians' cross movements and reverse flows exist, there is a high probability of conflict requiring frequent adjustment of speed and direction to avoid contact.

Designs consistent with this Level of Service would represent reasonably fluid flow. However, considerable friction and interaction between pedestrians are likely to occur, particularly in multidirectional flow situations. Examples of this type of design would be heavily used transportation terminals, public buildings, or open spaces where severe peaking, combined with space restrictions, limits design flexibility (Campisi et al., 2022).

Walkways: Level of Service D

Average Pedestrian Area Occupancy: 10–15 sq. ft. (1 m-1.4 m sq.) per person.

Average Flow Volume: 15–20 PFM,

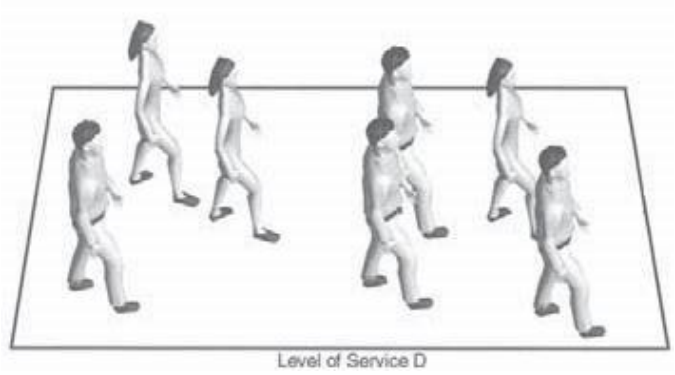

Figure 2.6 Level of service D

At Walkway Level of Service D, most people would have their normal walking speeds restricted and reduced, due to difficulties in bypassing slower-moving pedestrians and avoiding conflicts. Pedestrians involved in reverse flow and crossing movements would be severely restricted, with the occurrence of multiple conflicts with others. Designs at this Level of Service would be representative of the most crowded public areas, where it is necessary to alter walking stride and direction continually to maintain reasonable forward progress. At this Level of Service, there is some probability of intermittently reaching critical density, causing momentary stoppages of flow. Designs

consistent with this Level of Service would represent only the most crowded public areas (Watson et al., 2003).

Walkways: Level of Service E

Average Pedestrian Area Occupancy: 5–10 sq. ft. (.46–1 m sq.) per person.

Average Flow Volume: 20–25 PFM.

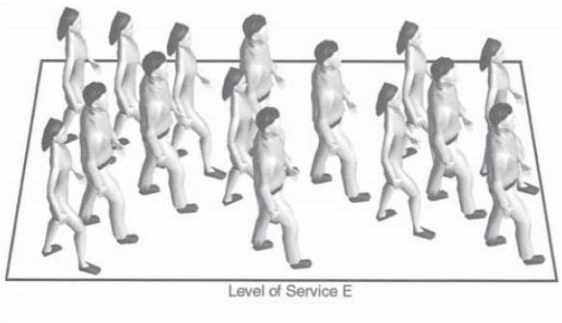

Figure 2.7 Level of service E

At Walkway Level of Service E, virtually all pedestrians would have their normal walking speeds restricted, requiring frequent adjustments of gait. At the lower end of the range, forward progress would only be made by shuffling. Insufficient areas would be available to bypass slower-moving pedestrians.

Extreme difficulties would be experienced by pedestrians attempting reverse flow and cross-flow movements (Benhadou et al., 2024)

Walkways: Level of Service F

Average Pedestrian Area Occupancy: 5 sq. ft. (.46 m sq.) per person or less.

2**Average Flow Volume:** Variable, up to 25 PFM.

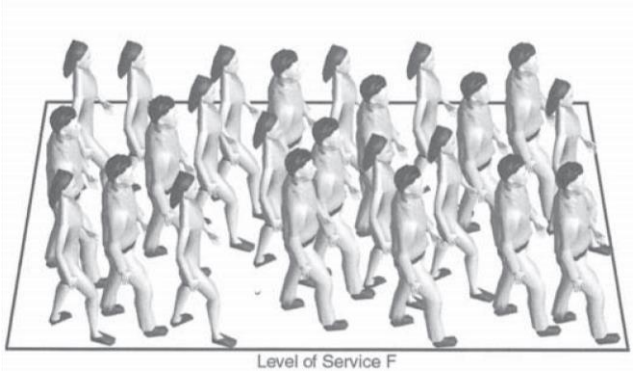

Figure 2.8 Level of service F

At Walkway Level of Service F, all pedestrian walking speeds are extremely restricted. Forward progress can only be made by shuffling. There would be frequent, unavoidable contact with other pedestrians, and reverse or crossing movements would be virtually impossible.

Traffic flow would be sporadic, with forward progress based on the movement of those in front. This Level of Service is representative of a loss of control and a complete breakdown in traffic flow. Pedestrian areas below 5 sq. ft. are more representative of queuing, rather than a traffic

flow situation. This Level of Service is not recommended for walkway design.(Benhadou et al., 2024)

2.3 Empirical literature review

2.3.1 Global experiences

Due to the lack of exact written documentation regarding the origins and timing of beggarly, there is confusing literature. Begging was "non-existent in primitive societies where mutual aid served as self-protection and security for the clan or even the whole tribe," according to Matei, (2013), on the one hand. This perspective emphasized how it emerged in connection with private property and prehistoric societies where begging was regarded as a noble deed and almsgiving as a holly deed (Mekuriaw & Dessalegn, 2017).

It is challenging to locate long-term research on begging in Africa. This suggests in part that the issue is not well-known or is not given much attention. Nonetheless, a plethora of research has been emerging in numerous African nations lately. Research from Nigeria, Tanzania, Ghana, Morocco, Senegal, South Africa, and Ethiopia that were currently available demonstrated how entrenched and unpleasantly widespread begging is. Many writers have explained this by saying that begging is common in most large cities across the continent, from the West's Nigeria Mekuriaw Hailu, (2017) to the East's Ethiopia Demewozu, (2005), where malnutrition and extreme poverty are the most common and historical conditions.

2.3.2 Impacts of begging

First and foremost, the large and increasing number of people who depend on begging for a living indicates that there are numerous and expanding populations of dependent and unproductive people, which wastes human resources and puts additional strain on the already overworked low-income earners who make up the majority of the labor force. Moreover, beggars may engage in a variety of lewd, violent, and illegal acts that undermine or disrupt the regular operations of society and impede the advancement of others (Mesele, 2020).

Second, begging harms not only the social and physical environment of cities but also the reputation of the country. Thus, the concentration of beggars in public areas and tourist destinations not only hinders unafraid human movements but also serves as a warning to the

tourism industry about the possibility that beggars may be robbers or gangsters (Mekuriaw Hailu, 2017).

On the other hand, the act of begging has negative repercussions on both human dignity and the image of the nation. Begging has repercussions on the social, psychological, political, cultural, economic, and other fronts as well as health-related issues. Furthermore, the negative effects of begging include prejudice, marginalization, segregation, isolation, conflict, and a reduction in social interactions and relationships. Similar emotions of guilt and shame, identity crises, verbal abuse-related fear, stress, anxiety, depression, distrust, hopelessness, loneliness, and adjustment issues are also experienced by beggars (Mesele, 2020).

Beyond the social and psychological discomfort that beggars cause, they also disturb people by using a variety of techniques, such as soliciting, unintentionally hugging, and insulting, to disturb people as they pass by on the streets, in cafés, hotels, taxis, and bus stops, and near places of worship. This is especially harmful to foreign visitors who wish to freely take in the natural beauty and cultural, social, and religious ceremonies and celebrations of our nation. Beggars squatting everywhere throughout the city have an effect not only on the aesthetics of the area but also on the number of visitors(Mekuriaw & Dessalegn, 2017).

Moreover, there is a lack of literature regarding the impact of street begging in Ethiopia even the existing ones are outdated, and they cannot represent the current context of begging (Mesele, 2020).

2.4 Research Gap

There is no comprehensive research on the effect of street begging on pedestrians' movement and safety so far in the existing body of literature. Though there are various research studies on related urban phenomena and social problems, there is a glaring research gap in the issue of how street begging in particular affects urban pedestrians 'mobility and safety. Many available papers take on more general aspects of urban life and don't pay much attention to the complex exchanges and subtle implications that arise as pedestrians share with street beggars the spaces they pass through. Therefore, an in-depth study of this intersection of urban sociology, security concerns, and pedestrian behavior is required to further our knowledge of the complex effects of street begging on the movement and safety of pedestrians.

2.5 Conceptual framework

A conceptual framework is a tool used by researchers to provide an organized structure and context for their research work. It is composed of relevant perspectives from interdisciplinary fields which then serve as the basis for communication between negotiators. The following figure is a diagram that categorizes variables into three distinct types: dependent variables, independent variables, and controlled variables. Dependent variables here show how the presence or area occupied by a beggar affects the speed at which pedestrians walk and their lateral position. The independent variable is a factor that is manipulated or varied to observe its effect on the dependent variables. In this figure, the controlled variables are "Street infrastructures and furniture. This implies that the physical environment, such as the street layout, benches, lamp posts, and other street furniture, remains unchanged during the experiment.

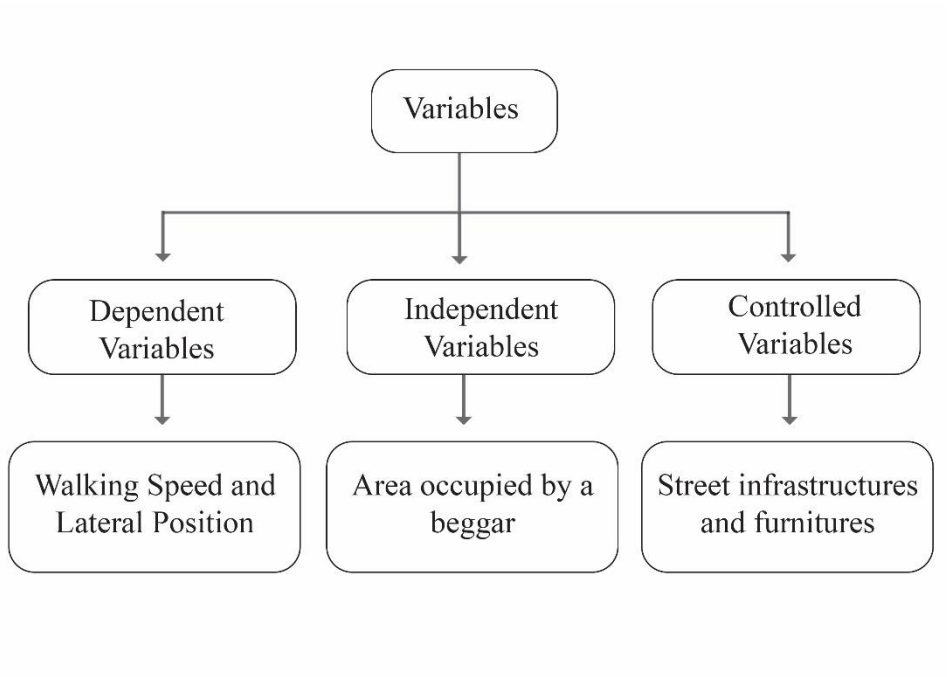

Figure 2.9 Study Variables

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This research aimed at assessing the impact of street begging on the movement flow and safety of pedestrians on walkways. Using supported data, the research constructed a methodological framework to achieve the objectives. The research assessed the available research design, data type, research populations/sample frame, and sampling technique used. Regarding data collection instruments, questionnaire design and techniques of data measurement were analyzed. All these steps are discussed within this chapter, providing an insight into the methodology employed for meeting the target results.

3.2 Description of the study area

Ethiopia's capital city, Addis Ababa, is the subject of this study. Located deep in Ethiopia's highlands, Addis Ababa serves as both the country's political and administrative hub and a melting pot of diverse cultures. At an approximate elevation of 2,355 meters (7,726 feet) above sea level, the city is in the Ethiopian highlands (UNEP, 2018).

Megenagna is one of the most crowded public areas in Addis Ababa with a significant intersection point for transportation services such as public buses and taxis. The public space is characterized by a long queue of people seeking transportation services and the informal traders who are vending their merchandise to the public transport seekers. These areas attract a wide range of people, providing opportunities to study how street begging influences the daily activities and experiences of pedestrians (Demewozu, 2005)(United Nations Human Settlements Programme Regional and Technical Cooperation Division., 2008).

The roads from Bole, Haya Hulet, shola, and Signal are the main thoroughfares that lead to the Diaspora and Megenagna roundabouts. Additionally, there is a highway from Imperial and a street that leads from the Diaspora roundabout to Arat Kilo, Wesen, and Kotebe. Among these streets, sidewalks and under-bridge passageways of pedestrians of the road leading to Bole, Shola, and a bridge passageway beside the roundabout as shown in Fig 3.1 were selected according to people’s congestion around it.

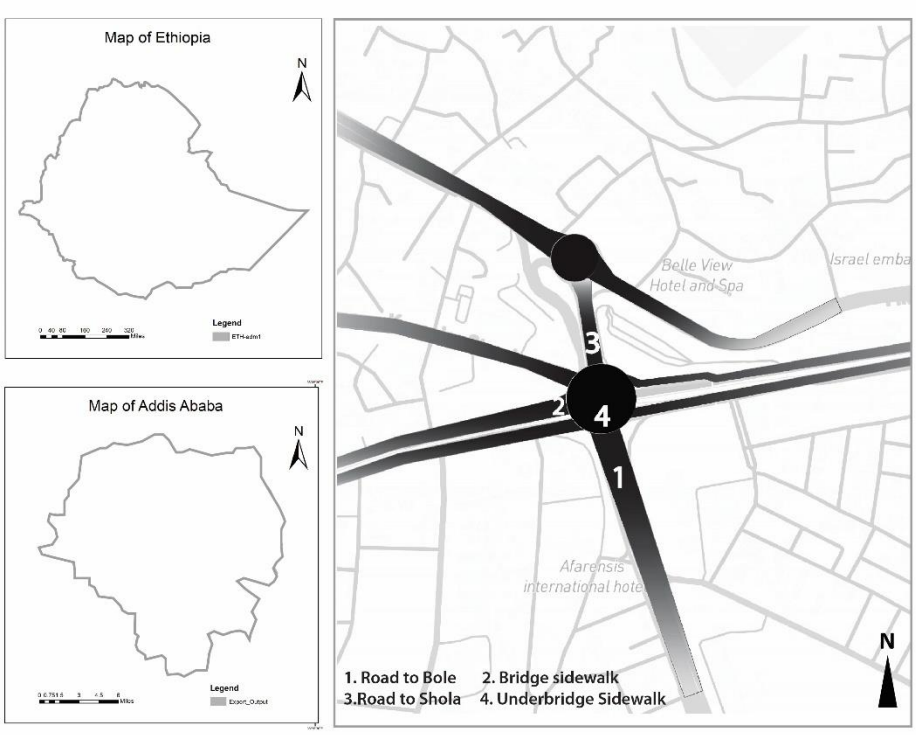

Figure 3.1 Location Map of the study

3.3 Research design

This section discussed the plan, structure, and strategy for investigating the impact of street begging on the movement and safety of pedestrians on the sidewalks of Megenagna, Addis Ababa. The strategy demonstrated how the research was conducted as well as the methods used for data collection and analysis. These approaches were intended to ensure that the key research questions were adequately addressed. Observations were conducted to record the time-delayed, and movement patterns of street begging incidents.

First, a baseline observation was held without any street begging activities to identify the impact of street begging without other variables being involved. In this way, the outcomes can be as a result of only street begging. The observations covered different times of the day and days of the week to capture variations. Second, a begging intervention observation was held with controlled instances of other obstacles with street beggars present on the street. Here, the impact can then be identified by comparing data obtained from the observation with and without street beggars involved. The pedestrians were surveyed to gather their perceptions and experiences related to street begging, safety concerns, and the impact on their movement.

Qualitative data from surveys were subjected to thematic analysis to identify safety concerns and perceptions. Pedestrian traffic flow was analyzed using technological tools (e.g., pedestrian flow sensors) to correlate the presence of street beggars with variations in movement patterns. Here is a flow chart:

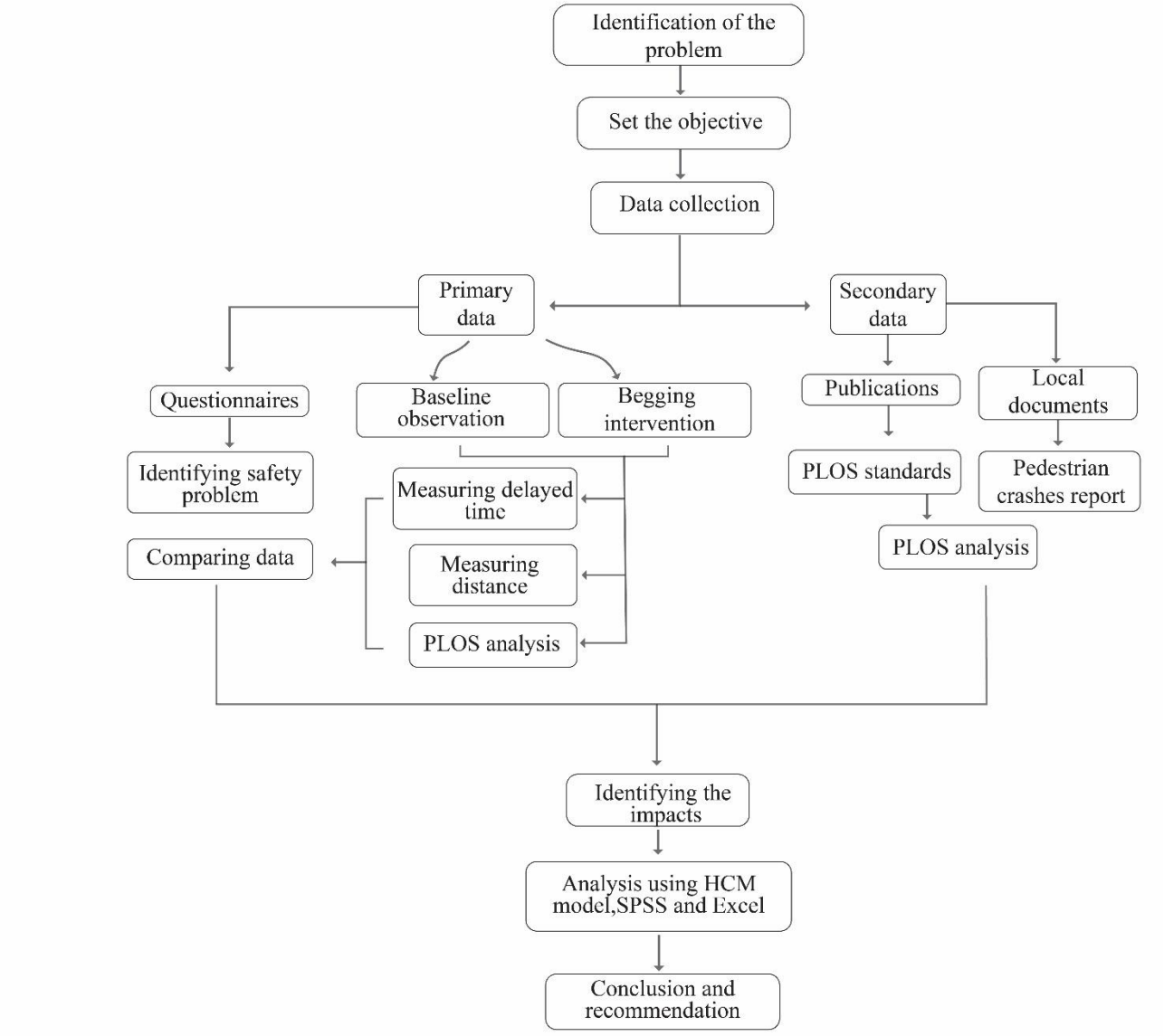

Figure 3.2 General Procedures

3.4 Study approaches

In this study, both quantitative and qualitative data were employed. The quantitative data analysis focused on determining the time delayed while walking on a congested walkway with and without beggars on the street, calculating the PLOS, and identifying the level of safety around the area. On the other hand, qualitative research methodology employed various alternative techniques, such as questionnaires and reviews of secondary data sources. This qualitative data gathered from questionnaires was utilized to ascertain whether street begging has an impact on the movement and safety of pedestrians.

3.5 Data type and sources

The present study accounted for both the primary and secondary data sources.

3.5.1 Primary data

For the study area, primary data was used. Primary data was collected through field surveys with videography of pedestrians' movement who use the sidewalks around Megenagna. It was explained based on primary sources from site observation and physical survey.

In addition, pedestrians were surveyed through questionnaires to gather their perceptions and experiences related to street begging, safety concerns, and the impact on their movement. Baseline observations and begging interventions were used in various locations and times to record the time delay and change of patterns of the street begging incidents with pedestrians. Data was collected through field notes, photography, and video recording.

3.5.2 Secondary data

Secondary data sources such as both published and unpublished documents, relevant research documents, journals, satellite images, articles, maps, and books were used. In addition, government policy, guidelines, reports, manuals, photographs, etc. were sources of secondary data. The paper utilized a mixed-use approach combining both quantitative and qualitative data.

3.6 Investigating the impact of street begging on the flow of pedestrians

Method and Material Used for the First Objective

Primary data through field observation was used to study sidewalk beggars' characteristics around Megenagna. The field observation was followed by a descriptive statistic to identify the typical dimensions and layout of the street segments along with the beggars for a video experiment.

For this study, four (4) street segments were selected based on their level of congestion. Each segment's pedestrian flows were studied through recorded video graphs. To mark the flow of the pedestrians, a camera was first calibrated using T-calibration software. The results from the calibration were useful for the automatic extraction of pedestrian trajectories with the T-analyst software.

From the video graph, pedestrians were selected to measure their walking speed and lateral position to gain accurate results. Then it was filtered to find the lowest speed score from the total number of pedestrians passing throughout the recorded video. The highest deviated distance among the selected passersby was also filtered for the lateral position. This helped in identifying which sidewalks are vulnerable to pedestrian crashes and accidents.

Baseline observations and begging interventions were used in various locations and times to record the time delay and change of patterns of the street begging incidents with pedestrians. Statistical methods were used to compare baseline data with data collected during street begging instances while generating descriptive statistics and exploring the correlations between street begging and pedestrian movement. Both baseline observations and begging interventions were held on the same day to avoid inaccuracies.

From a controlled experiment, lateral position and point speed data of pedestrians were extracted from the recorded video and prepared for two directions, different beggar types, and measurement points along the length of the observation area as shown in Figure 3.3. The length of the street segments varied from 9 meters to 15 meters.

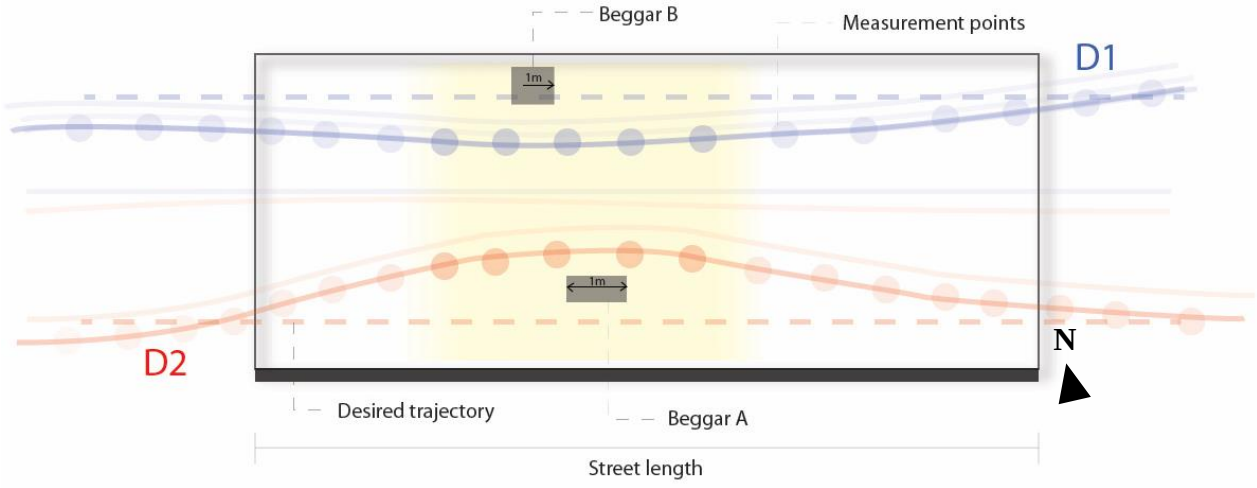

Figure 3.3 Layout of study ground (Sample Street segment)

The average walking speed with and without street beggars was recorded to compare the results of the speed delays and study the impact on walking speed. Whereas, lateral positions of the pedestrians were gained by recording the deviated distance from the desired trajectory because pedestrians avoid street beggars to maintain personal space. Extreme deviations from the sidewalks led to sharing carriageway of vehicles resulting in pedestrian crashes and accidents.

The study had two dependent variables: pedestrian walking speed and lateral position. The independent variable was the area occupied by a beggar. Since the types of beggars differ in the area they occupy on the sidewalk, their impact on walking delays and lateral position also differs.

Table 3.1 Selected Sidewalks Characteristics

No	Code of segment	Location of Sidewalk	Total Length	Lane Width	Surface material
1	A	Underpass	12	7	Terrazzo Pavement
2	B	Pedestrian Bridge	15	9	Terrazzo Pavement
3	C	Along Arterial Road	12	3.5	Terrazzo Pavement

4	D	Along Arterial Road	9	4	Terrazzo Pavement

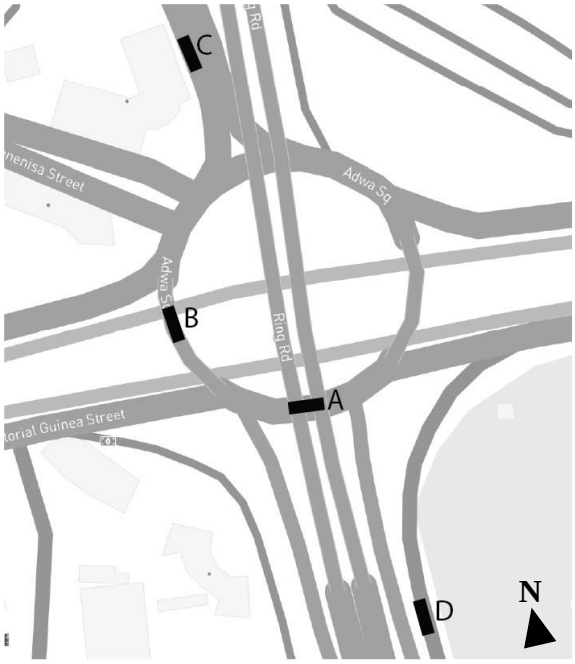

Figure 3.4 Selected Sidewalks in Megenagna

3.7 Evaluating the extent of congestion caused by street begging

Method and Material Used for the Second Objective

The second objective was to evaluate the level of congestion occurring on each selected street segment. To determine PLOS (Pedestrian level of service) scores, the pedestrian flow rate must be conducted. The pedestrian unit flow rate (ped/min/ft) was obtained by taking the pedestrian 15-minute flow rate (ped/15- min) and dividing it by the effective walkway width.

Pedestrian counts were conducted by extracting data from videography using Pe-track software. Videos were recorded on different days and times to ensure accurate and realistic results. They were recorded on the four street segments of the selected roads of the area. PLOS of the HCM rating used grading from A to F. This method is used for analyzing different means of transportation. It is based on the pedestrian traffic flow and the width of sidewalk space. According to HCM, the speed of a pedestrian is inversely proportional to pedestrian volume and density. As the density and volume increase, the speed of pedestrians declines.

Table 3.2 HCM Grading Values

NO	HCM Grade	HCM flow rate (Ped/15/m)
1	A	Score ≤ 5
2	B	5 ≤ Score ≤ 7
3	C	7 ≤ Score ≤ 10
4	D	10 ≤ Score ≤ 15
5	E	15 ≤ Score ≤ 23
6	F	Score ≤

Source 2 *Sahani, r. (2017). Service levels of sidewalks*

To identify the impact of street begging separately from the other sidewalk obstacles, multiple locations, and at various times, baseline observations and interventions of street begging were conducted separately using video graphs to monitor the duration and alterations in patterns of street beggars and vendors' activities. The baseline observations were compared with the data extracted from videos using analyst software with instances of street begging that were recorded at a close time.

Sidewalks could be congested for several reasons. Some of the obstacles are:

- Street Beggars
- Street Vendors
- Shoe Shining
- Food Vendors
- Demolished surface Material
- Infrastructures
- Street Furniture

3.8 Assessing the current safety problems faced by pedestrians

Method and Material Used for the Third Objective

Firstly, participants were selected from diverse demographics to ensure representation across age groups, genders, and socioeconomic backgrounds. Participants were briefed on the purpose of the study and assured of the confidentiality of their responses. The materials required to conduct the procedure were questionnaire forms printed or available format digitally.

The questionnaire was divided into sections focusing on demographic information, pedestrian behavior, observations of street begging activities, and safety concerns. Participants were asked about their residency or work tenure in the area, frequency of sidewalk use, observations of street begging, perceived safety, and any incidents or safety concerns related to street begging activities.

Data collected from the questionnaires was analyzed using both quantitative and qualitative methods. Quantitative data on demographics and frequency of responses was summarized using descriptive statistics. Qualitative data from close-ended questions was analyzed thematically to identify recurring themes and patterns in respondents' perceptions and suggestions.

Through this methodology, a comprehensive understanding of street begging activities and safety concerns on sidewalks was obtained, informing potential interventions and policy recommendations aimed at improving pedestrian safety and urban livability in the area.

3.9 Study population

The study population for the research around Megenagna consisted of pedestrians walking around Megenagna who were directly affected by or interacted with street begging on the specified sidewalks. Sampling techniques were adapted to the segments of the population. This variety helped to provide a more complete and nuanced understanding of the study's objectives.

3.10 Sampling technique

The study adopted Stratified sampling methods and purposive sampling methods. The stratified sampling method was applied for pedestrians and purposive sampling or judgmental sampling was applied for the selection of street segments. Pedestrians’ total population around Megenagna

was not exactly known and defined by exact numbers therefore, the study used unknown population calculation to determine the needed sample size.

3.11 Sample size

According to Bernard, (2011), a convenient sample of 384 pedestrians was used in this study. The sample size of 384 was calculated using Snedecor and Cochran, (1989)Equation (1) for an infinite population. The standard formula for the unknown population is: -

$$n = \frac{1.96^2\ p(1\text{-}p)}{e^2}$$

$$n=(1.96^2(0.5)(0.5))/0.05^2$$

$$n= 384.16$$

In this study, a convenient sample of 384 pedestrians was employed, as referenced by (Bernard and Russell H, 2011). The sample size of 384 was determined using equation (1) for an infinite population, as suggested by (Snedecor and Cochran, 1989). In this context, "p" represents the percentage of cases possessing the desired attribute, which in our study pertains to the proportion of pedestrians impacted by street begging. Meanwhile, "e" denotes the desired level of precision or error margin. If the value of "p" is unknown beforehand, it is customary to select a default value of 50% since this yield's maximum variability. Consequently, p=50% with e=5% for this study.

The criteria for selecting 4 sidewalk segments from the study area include the level of pedestrian congestion created on the walkways, the presence of street beggars being intense, active sidewalks, and the number of pedestrians passing through.

3.12 Data analysis and interpretation

3.12.1 Descriptive and Statistical Analysis

This study's analysis and interpretation of data employed both descriptive and statistical techniques. Descriptive analysis involves summarizing and visualizing data collected from field observations, questionnaires, and videography to provide an overall picture of pedestrian behavior and sidewalk conditions. Statistical analysis, on the other hand, utilizes methods such

as the HCM (Highway Capacity Manual) model to measure pedestrian flow rates and level of service (PLOS).

The descriptive analysis utilizes tools like MS Excel for data tabulation and graphical illustration, while software such as Adobe Illustrator and Photoshop is used for visual representation of site observations. This approach allows for the identification of patterns and changes in pedestrian behavior due to street begging, including time delays and deviations in walking trajectories.

In the statistical analysis, the HCM model quantifies pedestrian flow and assesses sidewalk capacity by grading the pedestrian level of service from A to F based on flow rates. The study had two dependent variables: pedestrian walking speed and lateral position. The independent variable is the area occupied by a beggar

3.13 Method of Validation

To validate the methodology of this study on the impact of street begging, some methods were employed. Statistical validation confirmed the reliability of results, and consistency checks verified data across different times and locations. The Pe-track software used for analysis was calibrated for accuracy, and ethical validation ensured participant privacy and adherence to ethical standards. These measures ensured the study's findings were accurate, reliable, and ethically sound, informing effective urban planning and policy interventions.

3.14 Ethical considerations

All those who took part in the study such as pedestrians and others received clear and comprehensive information on the research objectives, procedures, and benefits before participating in the study. Participants were informed consent; all may choose to withdraw from the study at any time. Personal information collected during the study (e.g., survey responses) was treated with strict confidentiality. The research team ensured that the voices of all participants, including those engaged in street begging, were heard, and respected without perpetuating stereotypes or stigmatization. The study adhered to ethical guidelines and standards of the research.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presented the analysis and discussion of the study's findings, focusing on data description, results, and discussion. The chapter is organized according to the research's specific objectives and questions. Both quantitative and qualitative data were required to achieve the research goals. It includes data collected from field observations, data collected from 384 respondents, the discussions on the compared results of baseline and begging interventions, and the grading value of each street segment's pedestrian level of service. The data collected were based on the objective of focusing on the pedestrian sidewalks and identifying their impacts on street begging on pedestrians. At the end, the summarized comparisons and discussions are also presented.

4.2 Impact on walking speed and lateral position

In this section, delays in walking speed and variations in lateral walking position within each segment were assessed, calculating the metrics accordingly. The distinctive features and conditions of each segment were analyzed individually. During the second intervention phase, six categories of beggars were found: able-bodied individuals, those with physical disabilities, child beggars, individuals who were weak or ill, mothers accompanied by children, and religious beggars.

4.2.1 Underbridge Sidewalk, Segment-A

Type of sidewalk: Underpass sidewalk

Location of sidewalk: Under the bridge of the major roundabout.

Date of data retrieved: Feb 20, 2024 Morning 9:08 AM

Duration of video recording: 15 min

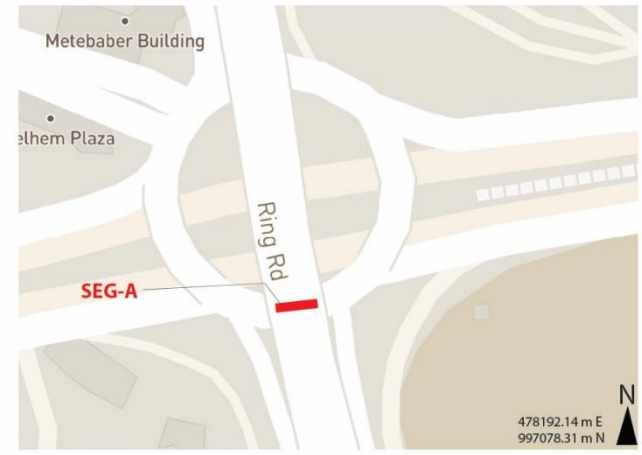

Figure 4.1 Segment-A

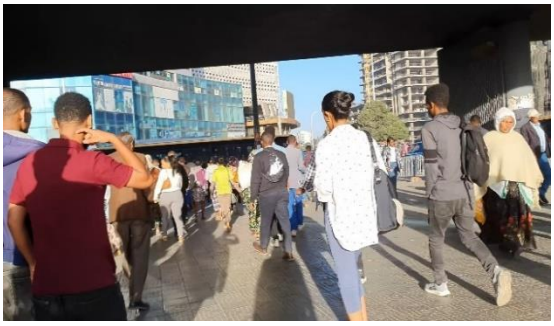

Figure 4.2 Field Image of Segment-A

Table 4.1 Characteristics of Segment-A

Street Width	Street Length	Street slope	No of obstacles	No of beggars
7	12	0.08%	2	2

4.2.1.1 Baseline Observation for Segment-A

Here, an observation was held without the presence of street beggars which is important in isolating other factors and obstacles of pedestrians on sidewalks from the street begging interventions.

No of obstacles: Two (2)

Type of obstacles: Street vendors

Area occupied by a vendor: 0.35 square meters (0.7m*0.5m)

Here is a top-view diagram of the layout of Segment-A while on baseline observation :

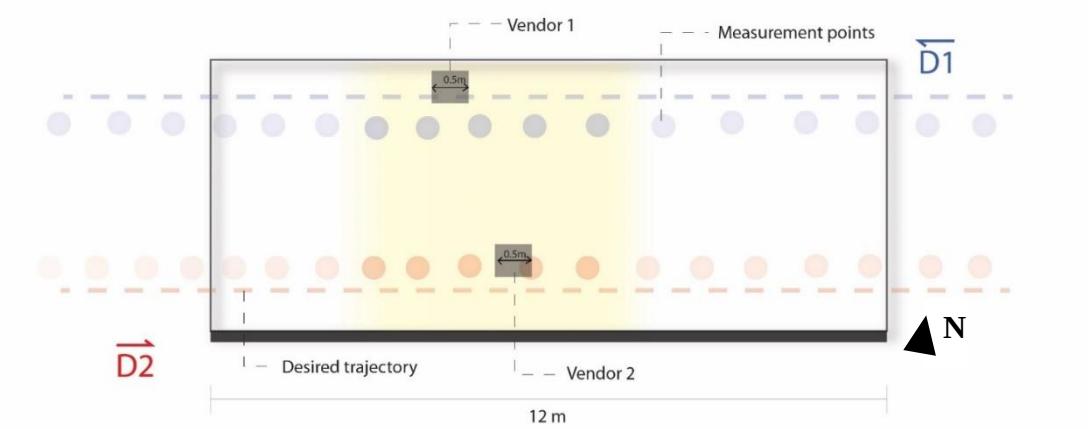

Figure 4.3 Segment-A Top View

Legend

Border of study ground

Measurement Points kept every 1 meter (counted from left to right)

Pedestrian Desired Trajectory

0.5m Space occupied by the vendor

D1 Walking direction to the left

D2 Walking direction to the right

Study Zone

4.2.1.2 Results for Baseline Observation (Segment-A)

The following table presents the lowest walking speed recorded and the highest deviation of distance measured on each measuring point for both the left and right directions of 30 pedestrians (fig4.4). Measurement points are kept every 1 meter. The lateral position was measured from the desired trajectory to the end of the forced trajectory. The calculation of the walking speed of a single pedestrian was done using the simple principle of motion:

$$V=D/t$$

where, V = walking speed [m/sec], D = measuring distance [m], and t = time spent walking the distance [sec]

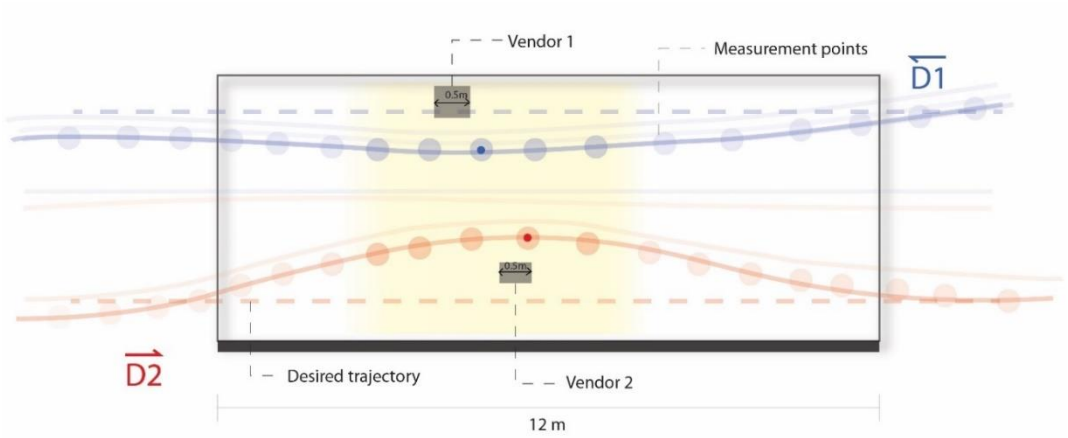

Figure 4.4 Graphical result for baseline observation (Segment-A)

Table 4.2 Tabular result for baseline observation (Segment-A)

	Points											
	1	2	3	4	5	6	7	8	9	10	11	12
Walking speed in D1 (m/s)	1.67	1.66	1.52	1.42	0.98	0.99	1.25	1.38	1.52	1.66	1.71	1.71
Walking speed in D2 (m/s)	1.51	1.13	1.06	1.02	0.9	0.92	0.93	1.11	1.29	1.4	1.53	1.68
Lateral position in D1 (m)	0.53	0.58	0.67	0.82	0.9	0.91	0.91	0.9	0.74	0.55	0.33	0.16
Lateral position in D2 (m)	0.17	0.19	0.36	0.57	0.99	1.28	1.34	1.32	1.2	0.66	0.34	0.17

Total Average speed for D1 and D2	1.33 m/s
Total average distance deviated	0.68 m

4.2.1.3 Begging Intervention of Segment-A

Here, a begging intervention was held with the presence of street beggars to finally compare it with the baseline observation.

No of obstacles: Two (2)

Type of obstacles: Street vendors

Area occupied by vendor: 0.35 square meters (0.7m*0.5m) each

No of beggars: Two (2)

Category of a beggar: An able-bodied beggar standing and a child beggar sitting.

Area occupied by beggar: 0.42 square meters (0.7m*0.6m) and 0.132 square meters (0.4m*0.33m) respectively.

Here is a top-view diagram of the layout of Segment-A while on baseline observation :

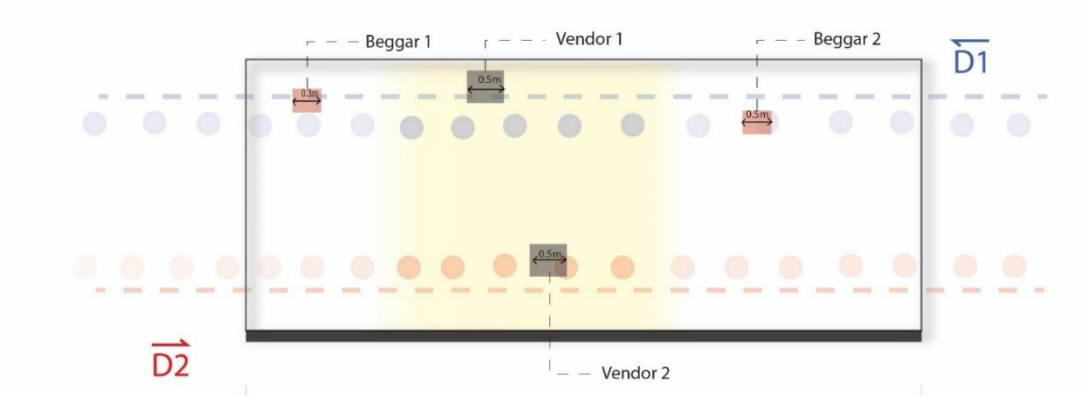

Figure 4.5 Segmnet-A with begging intervention

4.2.1.4 Results for Begging Intervention (Segment-A)

The table below displays the lowest recorded walking speed and the highest deviation of distance measured for each measuring point including instances of begging while keeping street vendors in the same position under control.

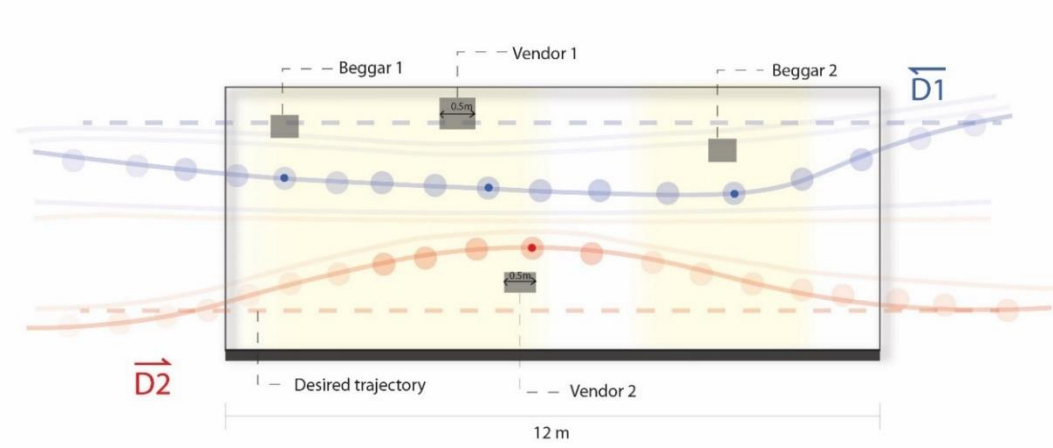

Figure 4.6 Graphical result for begging Intervention (Segment-A)

Table 4.3 Tabular result for begging Intervention (Segment-A)

	Points											
	1	2	3	4	5	6	7	8	9	10	11	12
Walking speed in D1 (m/s)	1.1	1	0.99	0.98	1.1	1.25	1.12	0.99	1.1	0.89	1.08	1.14
Walking speed in D2 (m/s)	1.51	1.13	1.07	1.04	0.89	0.91	0.93	0.97	1.29	1.46	1.55	1.67

Lateral position in D1 (m)	0.01	0.94	0.98	1.2	1.21	1.25	1.27	1.31	1.33	1.46	1.41	1.3
Lateral position in D2 (m)	0.17	0.19	0.36	0.57	0.99	1.28	1.34	1.32	1.2	0.66	0.34	0.17

Total Average speed for D1 and D2	1.04 m/s
Total average distance deviated	0.85 m

Here is a graph of a comparison between begging and baseline observations :

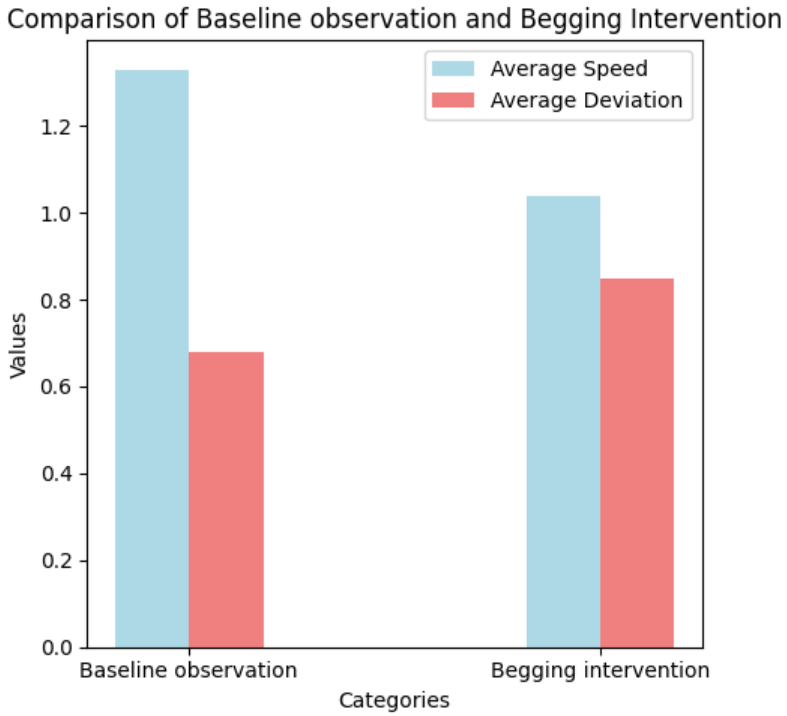

Figure 4.7 Comparison of Baseline observation and Begging Intervention (Segment A)

4.2.1.3 Discussion

Based on data extracted from a video of a walking experiment, where a 15-minute video of pedestrians was recorded to further study it on a Pe-track software, pedestrian trajectories in the absence as well as in the presence of begging activity were presented to identify the impact it has on pedestrians. From a controlled experiment, point speed data and lateral position of 30 pedestrians were prepared for two directions, two vendors and 2 beggars with 12 measurement points along the length of the observation area. The measurement points are x=1m, 2m, 3m, 4m... continue up to 12m in length at 1m intervals. The average walking speed, lateral position

with and without sidewalk beggars, and average values were also presented in Table 4.2 and Table 4.3. Now, to determine the impact or the effect of beggars on sidewalks we need to compare the results of both baseline and begging scenarios. For this, we subtract the average values of the first scenario from the second scenario. If the result shows a negative value for walking speed and a positive value for the lateral position, then there is a visible impact on street beggars on sidewalks.

In terms of walking speed, the baseline observation demonstrates relatively consistent speeds across the measuring points, ranging from 0.98 m/s to 1.71 m/s in D1 and 0.90 m/s to 1.68 m/s in D2. However, following the begging intervention, there is a noticeable decrease in walking speed in both D1 and D2, with average speeds dropping to 1.1 m/s and 1.04 m/s, respectively.

Regarding lateral position, the baseline observation shows varying degrees of deviation from the centerline, with lateral positions ranging from 0.16 m to 0.91 m in D1 and 0.17 m to 1.34 m in D2. Interestingly, the begging intervention demonstrates a significant shift in the lateral position, particularly in D1, where participants exhibit a wider spread, with lateral positions ranging from 0.01 m to 1.33 m.

On the begging intervention, pedestrians walking in D1 gradually lowered their speed from entry to exit Fig 4.6. The effect on pedestrians walking in D1 varied with the presence of begging instances. Under the first scenario, pedestrians' walking speed in D1 was less influenced by the presence of sidewalk vendors. Whereas under the second scenario, pedestrians lowered their walking speed as they approached the center point of a beggar activity and then accelerated after passing the beggar Fig. 4.6 and Table 4.3.

Pedestrians in D1 of begging intervention showed a large deviation from the desired trajectory. The larger the beggar's size, the bigger the lateral deviation with its maximum at the center of the sidewalk beggar. While those pedestrians in D2 had no change compared to the baseline scenario since there were no begging instances along the path.

Comparing both scenarios, the subtracted value of the average walking speed was -0.29 m/s i.e. (speed 2-speed1) and the subtracted value of lateral position was 0.17 m. This decline in walking speed and a positive increase in deviation indicated that begging instances on sidewalks had an impact on pedestrians' walking speed and position.

4.2.2 Bridge Sidewalk, Segment-B

Type of sidewalk: Pedestrian Bridge

Location of sidewalk: On the bridge of the major roundabout.

Date of data retrieved: Mar 02, 2024 Day time 12:15 AM

Duration of video recording: 15 min

Figure 4.9 Segment-B

Figure 4.8 Field Image of Segment-B

Table 4.4 Characteristics of Segment-B

Street Width	Street Length	Street slope	No of obstacles	No of beggars
9	15	0.02%	1	3

4.2.2.1 Baseline Observation for Segment-B

Here, an observation is held without the presence of street beggars which is important in isolating other factors and obstacles of pedestrians on sidewalks from the street begging interventions.

No of obstacles: One (1)

Type of obstacles: Deteriorated Surface Material

Area occupied by the obstacle: 1.5 square meters (0.3m*5m)

Here is a top-view diagram of the layout of Segment-A while on baseline observation :

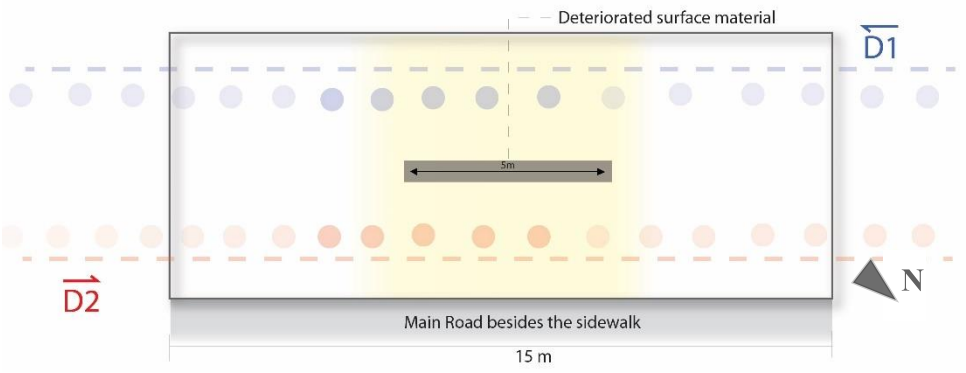

Figure 4.10 Segment-B Top View

4.2.2.2 Results for Baseline Observation (Segment-B)

The following table presents the lowest walking speed recorded and the highest deviation of distance measured on each measuring point for both the left and right directions of 30 pedestrians (fig.4.11).

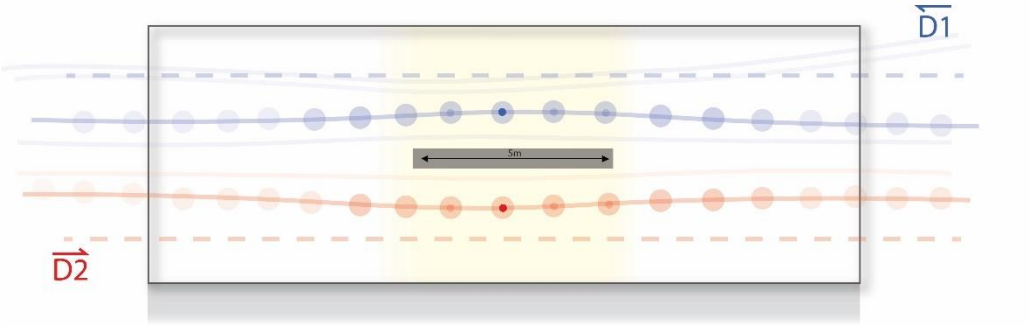

Figure 4.11 Graphical result for baseline observation (Segment-B)

Table 4.5 Tabular result for Baseline observation (Segment-B)

	Points														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Walking speed in D1 (m/s)	1.78	1.74	1.7	1.64	1.59	1.55	1.48	1.43	1.49	1.51	1.52	1.54	1.59	1.64	1.66
Walking speed in D2 (m/s)	1.7	1.66	1.62	1.6	1.55	1.48	1.41	1.41	1.44	1.5	1.56	1.61	1.66	1.7	1.7
Lateral position in D1 (m)	0.33	0.34	0.36	0.37	0.38	0.39	0.4	0.4	0.4	0.39	0.38	0.36	0.34	0.33	0.32

Lateral position in D2 (m)	0.34	0.34	0.35	0.35	0.36	0.36	0.37	0.38	0.38	0.37	0.37	0.36	0.35	0.34	0.34

Total Average speed for D1 and D2	1.37 m/s
Total average distance deviated	0.34 m

4.2.2.3 Begging Intervention of Segment-B

Here, a begging intervention is held with the presence of street beggars to finally compare it with the baseline observation.

No of beggars: Three (3)

Category of beggar: Physically Handicapped in a sleeping position, child beggar standing, and an able-bodied beggar standing.

Area occupied by beggar: 0.9 square meters (0.6m*1.5m), 0.132 square meters (0.4m*0.33m), and 0.49 square meters (0.7m*0.7m) respectively.

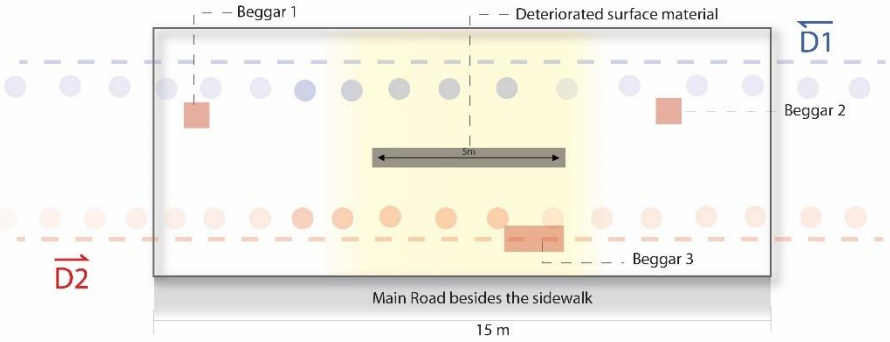

Figure 4.12 Segmnet-B with begging intervention

4.2.2.4 Results for Begging Intervention (Segment-B)

The table and the Figure i.e. fig 4.13 below display the lowest recorded walking speed and the highest deviation of distance measured for each measuring point including instances of begging while keeping other obstacles under control. The distance is measured from the center of the deteriorated sidewalk tiles.

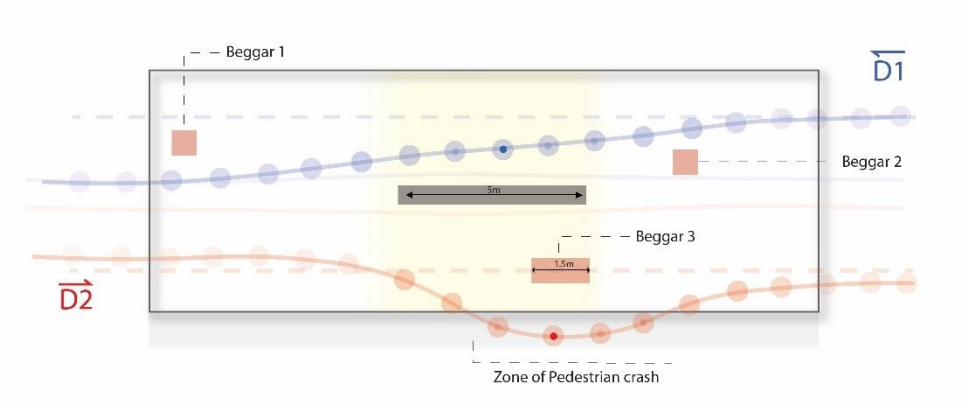

Figure 4.13 Graphical result for begging Intervention (Segment-B)

Table 4.6 Tabular result for begging Intervention (Segment-B)

	Points														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Walking speed in D1 (m/s)	0.92	0.93	0.93	1.31	1.39	1.46	1.52	1.54	1.59	1.63	1.5	1.46	1.46	1.52	1.6
Walking speed in D2 (m/s)	1.7	1.66	1.5	1.48	1.41	1.36	1.29	1.2	1.1	0.95	0.91	0.88	1.14	1.25	1.3
Lateral position in D1 (m)	1.6	1.58	1.52	1.47	1.36	1.3	1.24	1.1	0.7	0.4	0.37	0.3	0.24	0.2	0.1
Lateral position in D2 (m)	0.12	0.13	0.13	0.13	0.1	0.8	1.04	1.23	1.45	1.45	1.4	1.3	1.23	0.8	0.5

Total Average speed for D1 and D2	1.15 m/s
Total average distance deviated	0.6 m

Here is a graph of a comparison between begging and baseline observations :

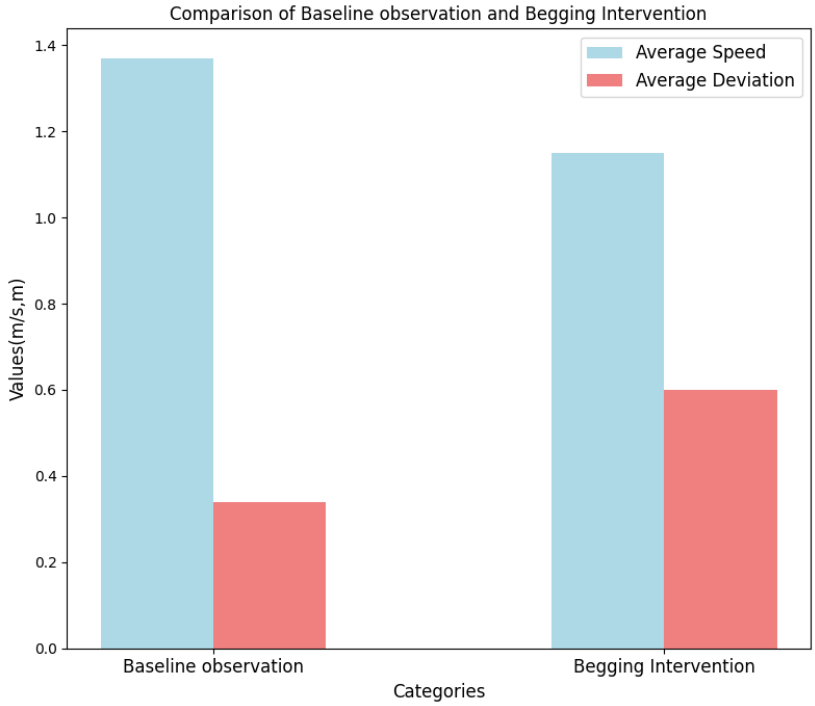

Figure 4.14 Comparison of Baseline observation and Begging Intervention (Segment B)

4.2.2.5 Discussion

Firstly, focusing on walking speed, the baseline observation demonstrates relatively high and consistent speeds, with average speeds ranging from 1.55 m/s to 1.66 m/s in D1 and 1.48 m/s to 1.70 m/s in D2. In contrast, the beginning intervention results in a notable decrease in average walking speeds, particularly in D1, where speeds drop to an average of 1.44 m/s. Although D2 maintains similar speeds initially, there's a considerable decline towards the latter points, with speeds dropping to 1.20 m/s and 0.91 m/s towards the end of the intervention. This decline in walking speed in both D1 and D2 suggests a significant adjustment or response from participants to the intervention's parameters or requirements.

Secondly, regarding lateral position, the baseline observation indicates relatively consistent positioning, with lateral positions ranging from 0.32 m to 0.40 m in D1 and 0.34 m to 0.38 m in D2. However, the begging intervention results in a considerable shift in lateral positioning, particularly in D1, where participants exhibit a wide range of lateral positions, ranging from 0.10 m to 1.60 m. This suggests that the intervention prompted participants to share carriageways with vehicles which is a risk of a pedestrian crash.

Comparing both scenarios, the subtracted value of the average walking speed was -0.22 m/s i.e. (speed 2-speed1) and the subtracted value of the lateral position was 0.26 m. This decline in walking speed and a positive increase in deviation indicated that begging instances on sidewalks impacted pedestrians' walking speed and position.

4.2.3 Road to Shola, Segment-C

Type of sidewalk: Sidewalk along an arterial road.

Location of sidewalk: Along the arterial road.

Date of data retrieved: Mar 14, 2024 Evening 4:05 AM

Duration of video recording: 15 min

Figure 4.16 Segment-C

Figure 4.15 field Image of Segment-C

Table 4.7 Characteristics of segment-C

Street Width	Street Length	Street slope	No of obstacles	No of beggars
3.5	12	0.02%	3	2

4.2.3.1 Baseline Observation for Segment-C

Here, an observation is held without street beggars which is important in isolating other factors and obstacles of pedestrians on sidewalks from the street begging interventions.

No of obstacles: Three (3)

Type of obstacles: Illegally occupied sidewalk area by a construction site, a shoeshine boy, and a vendor.

Area occupied by the obstacle: 26 square meters (irregularly shaped region), 1.8 square meters (1m*1.8m), and 0.35 square meters(0.7*0.5) respectively.

Here is a top-view diagram of the layout of Segment-C while on baseline observation :

Figure 4.17 Segment-C Top View

4.2.3.2 Results for Baseline Observation (Segment-C)

The following table presents the lowest walking speed recorded and the highest deviation of distance measured on each measuring point for both the left and right directions of 30 pedestrians (fig.4.18).

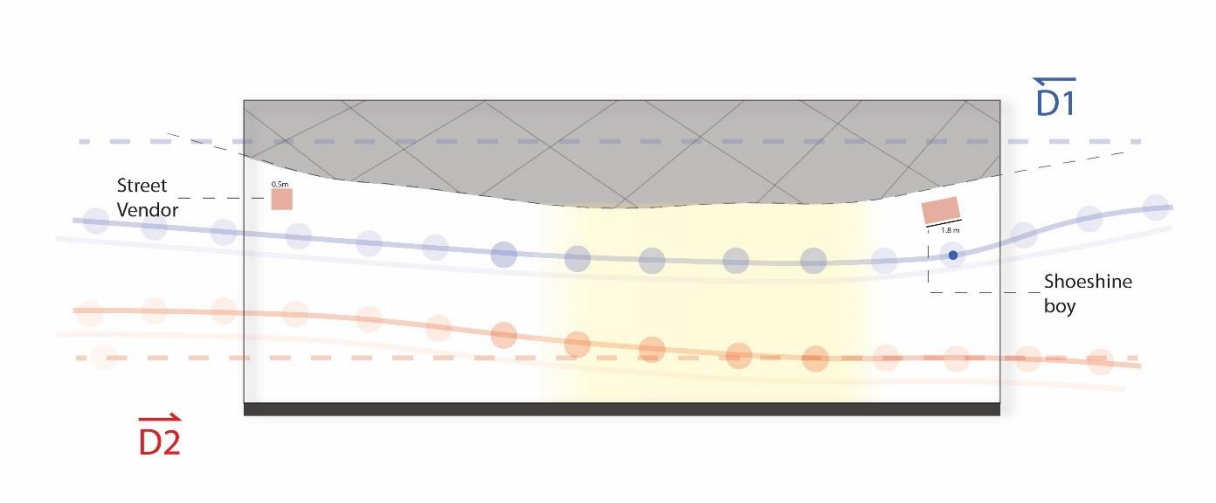

Figure 4.18 Graphical result for baseline observation (Segment-C)

Table 4.8 Tabular result for baseline observation (Segment-C)

	Points											
	1	2	3	4	5	6	7	8	9	10	11	12
Walking speed in D1 (m/s)	1.71	1.68	1.6	1.55	1.3	1.26	1.22	1.18	0.98	1.11	1.19	1.2
Walking speed in D2 (m/s)	1.51	1.43	1.39	1.34	1.3	1.27	1.23	1.19	1.13	1.17	1.25	1.3
Lateral position in D1 (m)	2.16	2.16	2.18	2.2	2.17	2.17	2.15	2.1	1.6	1.4	1.24	1.1
Lateral position in D2 (m)	0.67	0.55	0.47	0.32	0.2	0.17	0.12	0.08	0.06	0.03	0	0

Total Average speed for D1 and D2	1.25 m/s
Total average distance deviated	1.102 m

4.2.3.3 Begging Intervention for Segment-C

Here, a begging intervention is held with the presence of street beggars to finally compare it with the baseline observation.

No of beggars: Two (2)

Category of beggar: Religious Beggar and a mother with children beggar

Area occupied by beggar: 1.8 square meters (1.2m*1.5m) and 1.8 square meters (1m*1.8) respectively.

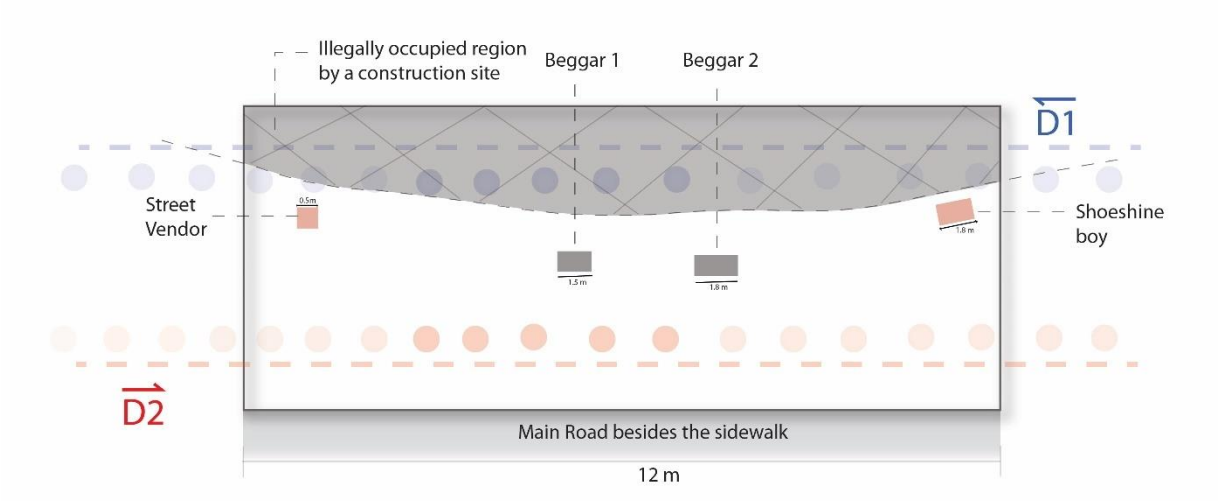

Figure 4.19 Segmnet-C with begging intervention

4.2.3.4 Results for Begging Intervention (Segment-C)

The table and the figure i.e. fig 4.20 below display the lowest recorded walking speed and the highest deviation of distance measured for each measuring point including instances of begging while keeping other obstacles under control.

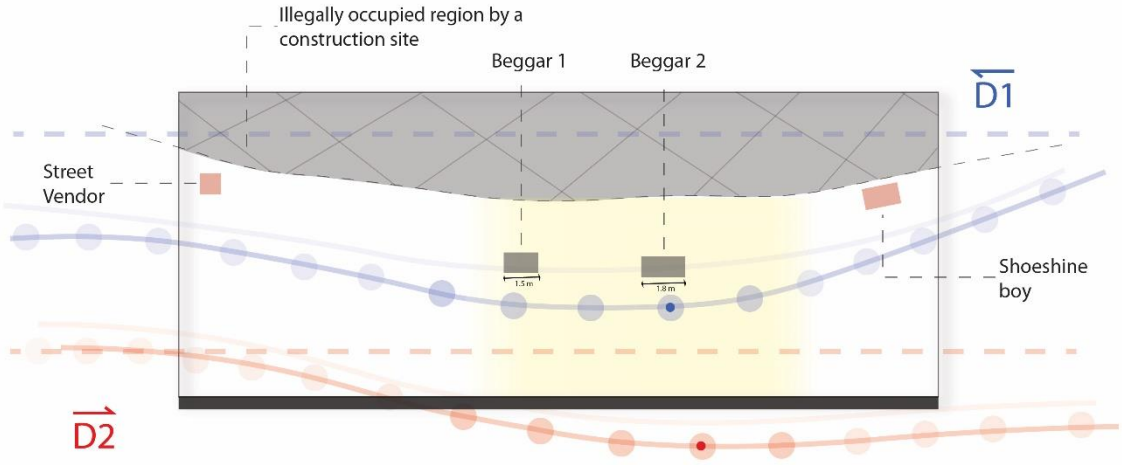

Figure 4.20 Graphical result for begging Intervention (Segment-C)

Table 4.9 Tabular result for begging Intervention (Segment-C)

	Points											
	1	2	3	4	5	6	7	8	9	10	11	12
Walking speed in D1 (m/s)	1.1	1	0.99	0.8	0.75	0.86	0.9	1.08	1.2	1.3	1.4	1.4
Walking speed in D2 (m/s)	1.22	1.2	1.14	0.98	0.88	0.89	1.15	1.23	1.3	1.37	1.4	1.5
Lateral position in D1 (m)	2.33	2.41	2.5	2.6	2.8	3.1	3.2	3.2	3	2.6	2.4	2.3
Lateral position in D2 (m)	0	0.12	0.18	0.3	0.5	0.8	1.1	1.3	1.3	1.24	1.23	1.2

Total Average speed for D1 and D2	0.97m/s
Total average distance deviated	1.72 m

Here is a graph of a comparison between begging and baseline observations :

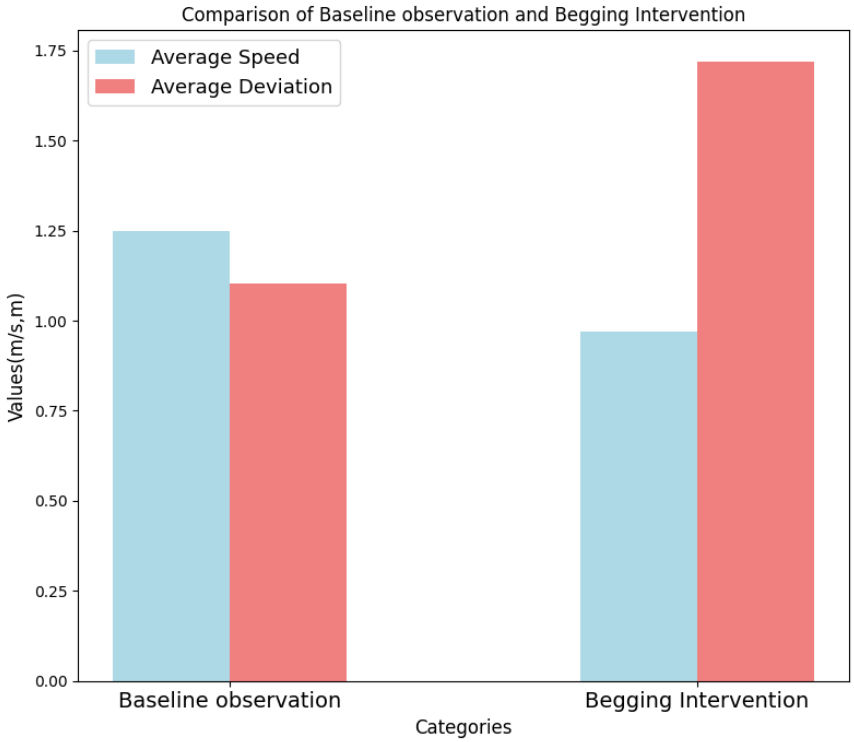

Figure 4.21 Comparison of Baseline observation and Begging Intervention (Segment C)

4.2.3.5 Discussion

Comparing the averages of walking speeds between the two scenarios, we notice that in the first baseline observation, the average walking speed for D1 is 1.29 m/s, while for D2, it is 1.28 m/s. In contrast, the second begging intervention shows a lower average walking speed for both directions: 1.07 m/s for D1 and 1.21 m/s for D2. This indicates a slightly lower average walking speed in the second compared to the first, although both tables generally show a similar trend of decreasing walking speed from points 1 to 12.

When considering lateral positions, the average lateral position in D1 in the second table is notably higher (2.72 m) compared to that in the second table (1.89 m). However, for D2, the average lateral position in the first table is significantly lower (0.206 m) compared to the second table (0.69 m). This suggests that in the second table, participants tend to maintain a more peripheral lateral position in D1 and D2, while in the first table, lateral positions are slightly central in both directions. The peripheral positions tended to be out of the borders of the sidewalks as shown in Fig 30, which led the pedestrians to share a carriageway with vehicles and this clearly showed a point of pedestrian crash risk.

In terms of overall speed and deviation, the first table indicates a total average speed of 1.25 m/s across both directions, with a total average deviation of 1.102 m. On the other hand, the second table shows a slightly lower total average speed of 0.97 m/s but a higher total average deviation of 1.72 m. This implies that while participants in the begging scenarios walk slower on average, they tend to deviate more from a central position compared to those in the baseline scenarios. The subtracted values of the averages between the two scenarios are -0.28 m/s and 0.618 m. So, the result has clearly shown that begging instances had a visible impact on the speed and position of pedestrians.

4.2.4 Road to Bole, Segment-D

Type of sidewalk: Sidewalk along an arterial road.

Location of sidewalk: Along the arterial road.

Date of data retrieved: Mar 26, 2024 Evening 12:30 PM

Duration of video recording: 15 min

Figure 4.23 Segment D

Figure 4.22 Field Image of Segment D

Table 4.10 Characteristics of Segment D

Street Width	Street Length	Street slope	No of obstacles	No of beggars
4	9	0.04%	2	1

4.2.4.1 Baseline Observation For Segment-D

Here, an observation is held without street beggars which is important in isolating other factors and obstacles of pedestrians on sidewalks from the street begging interventions.

No of obstacles: Two (2)

Type of obstacles: Food vending and a street light pole.

Area occupied by the obstacle: 3.6 square meters (1.2m*3m) and 0.02 square meters (0.18 diameter) respectively.

Here is a top-view diagram of the layout of Segment-C while on baseline observation :

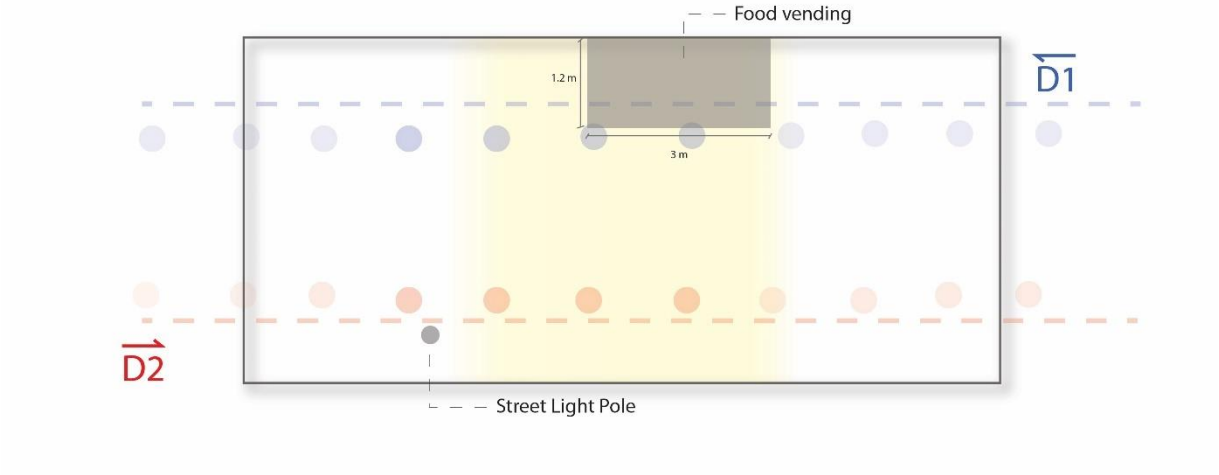

Figure 4.24 Segment D Top View

4.2.4.2 Results for baseline observation of segment D

The table and the figure i.e. fig 35 below display the lowest recorded walking speed and the highest deviation of distance measured for each measuring point including instances of begging while keeping other obstacles under control.

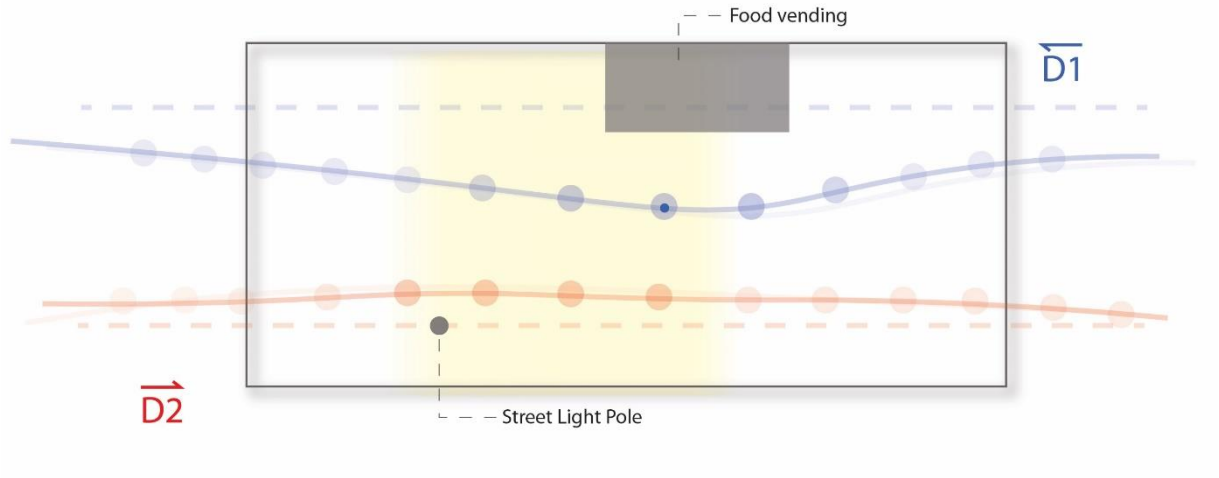

Figure 4.25 Graphical result for baseline observation (Segment-D)

Table 4.11 Tabular result for baseline observation (Segment-D)

	Points								
	1	2	3	4	5	6	7	8	9
Walking speed in D1 (m/s)	1.73	1.72	1.7	1.65	1.45	1.3	1.33	1.4	1.48
Walking speed in D2 (m/s)	1.77	1.76	1.75	1.75	1.75	1.77	1.78	1.78	1.8
Lateral position in D1 (m)	0.83	0.85	0.9	0.95	1.2	1.3	1.28	1.25	0.97
Lateral position in D2 (m)	0.22	0.23	0.24	0.23	0.22	0.21	0.21	0.21	0.2

Total Average speed for D1 and D2	1.65 m/s
Total average distance deviated	0.64 m

4.2.4.3 Begging Intervention for Segment-D

Here, a begging intervention is held with the presence of street beggars to finally compare it with the baseline observation.

No of beggars: One(1)

Category of beggar: A physically handicapped beggar in a sleeping position.

Area occupied by beggar: 1.2 square meters (0.8*1.5m)

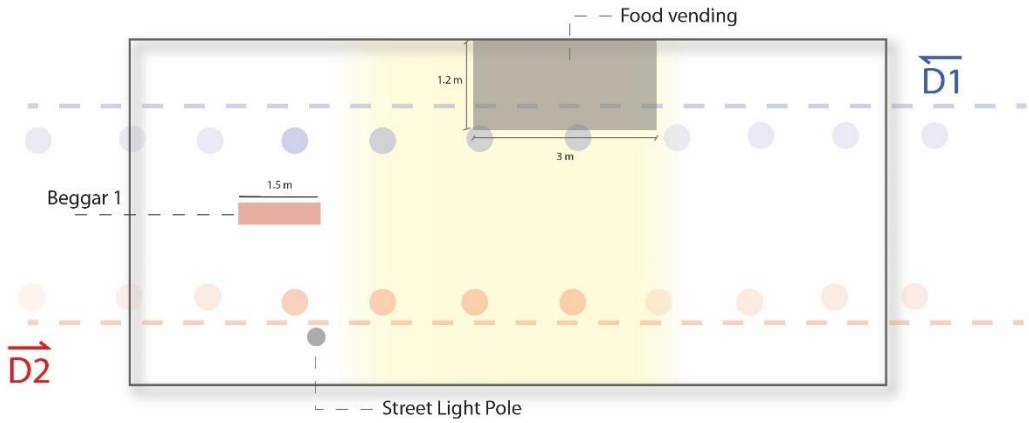

Figure 4.26 Segmnet-D with begging intervention

4.2.4.4 Results for Begging Intervention (Segment-D)

The table and the figure below display the lowest recorded walking speed and the highest deviation of distance measured for each measuring point including instances of begging while keeping other obstacles under control. In this segment, luckily two similar lower-recorded walking speeds with different trajectories were recorded. Here is the first generated trajectory of a pedestrian.

Trajectory 1:

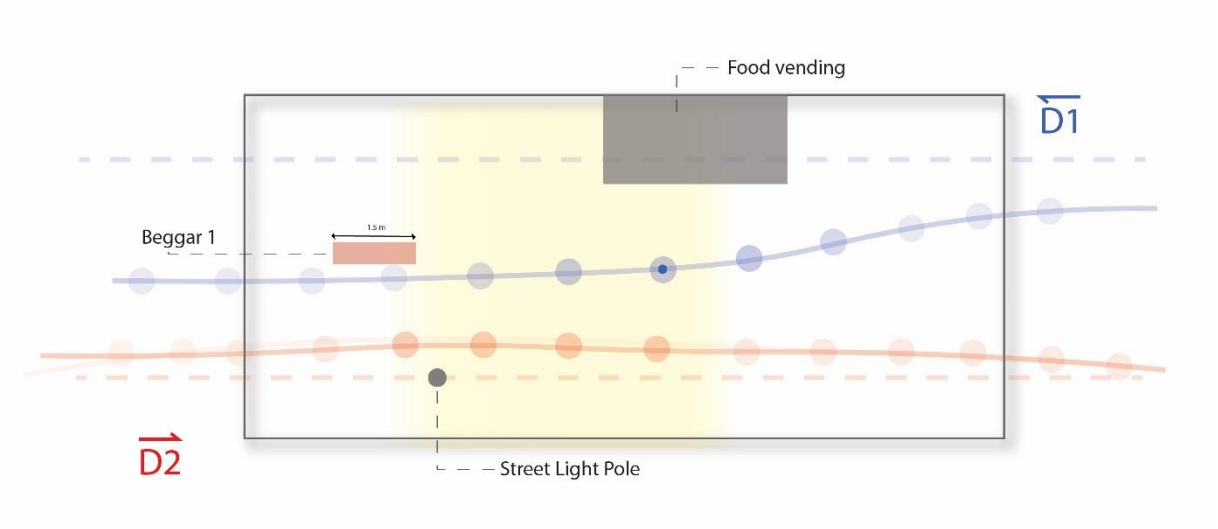

Figure 4.27 Graphical result for Begging Intervention (Segment-D) of trajectory 1

Trajectory 2 :

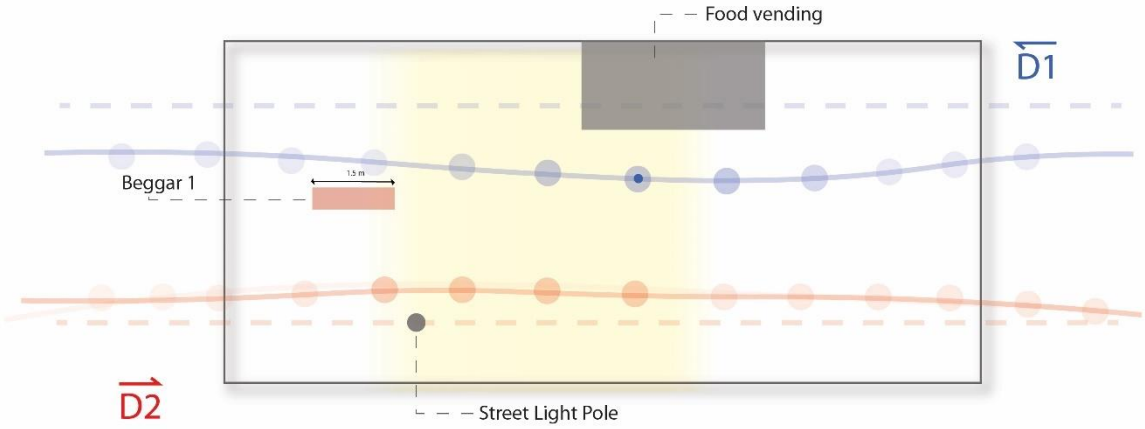

Figure 4.28 Graphical result for Begging Intervention (Segment-D) of trajectory 2

Table 4.12 Tabular result for begging intervention (Segment-D) for trajectory 1

	Points								
	1	2	3	4	5	6	7	8	9
Walking speed in D1 (m/s)	1.73	1.65	1.5	1.4	1.33	1.24	1.01	0.9	0.87
Walking speed in D2 (m/s)	1.77	1.76	1.75	1.75	1.75	1.77	1.78	1.78	1.8
Lateral position in D1 (m)	0.83	0.85	0.9	0.95	1.2	1.3	1.42	1.51	1.55
Lateral position in D2 (m)	0.22	0.23	0.24	0.23	0.22	0.21	0.21	0.21	0.2

Total Average speed for D1 and D2	1.48 m/s
Total average distance deviated	0.77 m

Table 4.13 Tabular result for begging intervention (Segment-D) for trajectory 2

	Points								
	1	2	3	4	5	6	7	8	9
Walking speed in D1 (m/s)	1.73	1.65	1.5	1.4	1.33	1.24	1.01	0.9	0.87
Walking speed in D2 (m/s)	1.77	1.76	1.75	1.75	1.75	1.77	1.78	1.78	1.8
Lateral position in D1 (m)	0.83	0.85	0.87	0.87	0.74	0.7	0.6	0.55	0.43
Lateral position in D2 (m)	0.22	0.23	0.24	0.23	0.22	0.21	0.21	0.21	0.2

Total Average speed for D1 and D2	1.48 m/s
Total average distance deviated	0.45 m

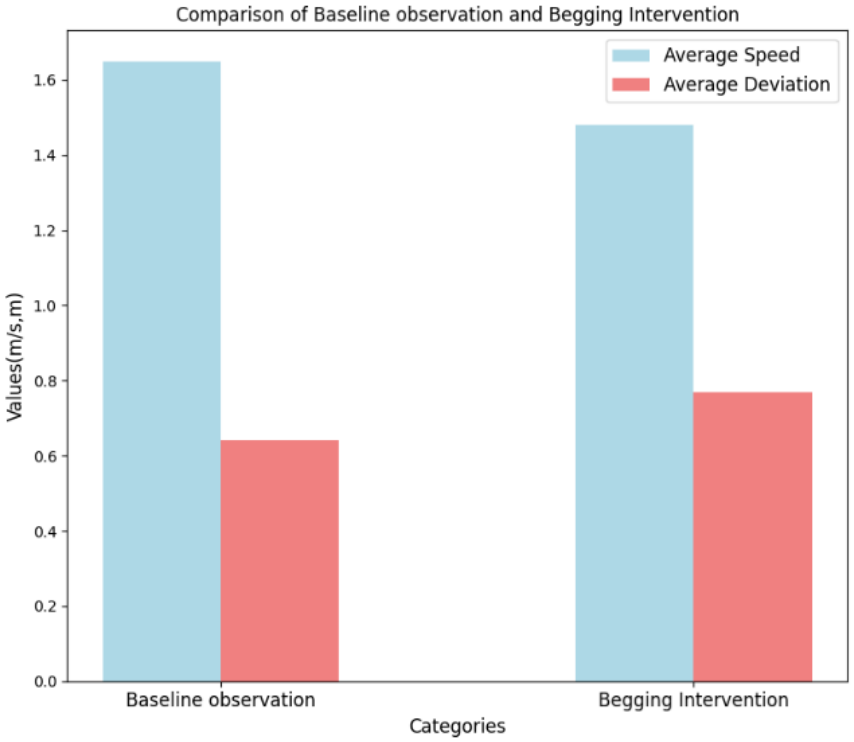

Figure 4.29 Comparison of Baseline observation and Begging Intervention (Segment D)

4.2.4.5 Discussion

In the first baseline observation result, we observe a gradual decline in walking speed from the first to the ninth point in both D1 and D2 sessions. While there are slight fluctuations in D1, the speeds in D2 remain relatively consistent throughout the observation points. While on the begging instance, the speed on D1 was even lower than the former one. This shows that the begging instance, which in the case was a disabled beggar occupying a larger area on the sidewalk had a visible impact on the pedestrian's walking speed.

Conversely, the lateral position data shows a consistent increase from the first to the ninth point in both D1 and D2 sessions on both scenarios, indicating a gradual shift towards the right side of the path. This lateral deviation led individuals to shy off their desired path gradually.

The total average speed for both D1 and D2 sessions in the first table is calculated as 1.65 m/s, with an average deviation distance of 0.64 m. This suggests a moderate level of deviation from the intended path. In contrast, the second table presents a decline in walking speed from the first to the ninth point in both D1 and D2 sessions. This sharp decrease in speed, coupled with an

increased lateral position, indicates a more significant deviation from the intended path compared to the first table.

The total average speed for both D1 and D2 sessions in the second table is calculated as 1.48 m/s, with an increased average deviation distance of 0.77 m. This indicates a higher level of deviation compared to the first table, suggesting that begging instance had an impact on the variables. The two similarly recorded trajectories had the same walking speed with slightly varying deviations in the distance as seen in Tables 4.12 and 4.13.

4.2.5 Summarized comparison of walking speed and position of all segments

Here is a discussion for the summary in fig 4.30. All segments exhibited negative average speeds, indicating a decrease in walking speed from the starting point. However, Segment A demonstrates a lower average speed but a relatively controlled deviation, while Segment D displays a slightly higher average speed but a more controlled deviation. This suggests that pedestrians in Segment D might have been uninterrupted during walking. In contrast, Segment B showcases a negative average speed, but with a higher average distance deviated, implying a less controlled deviation from the intended path.

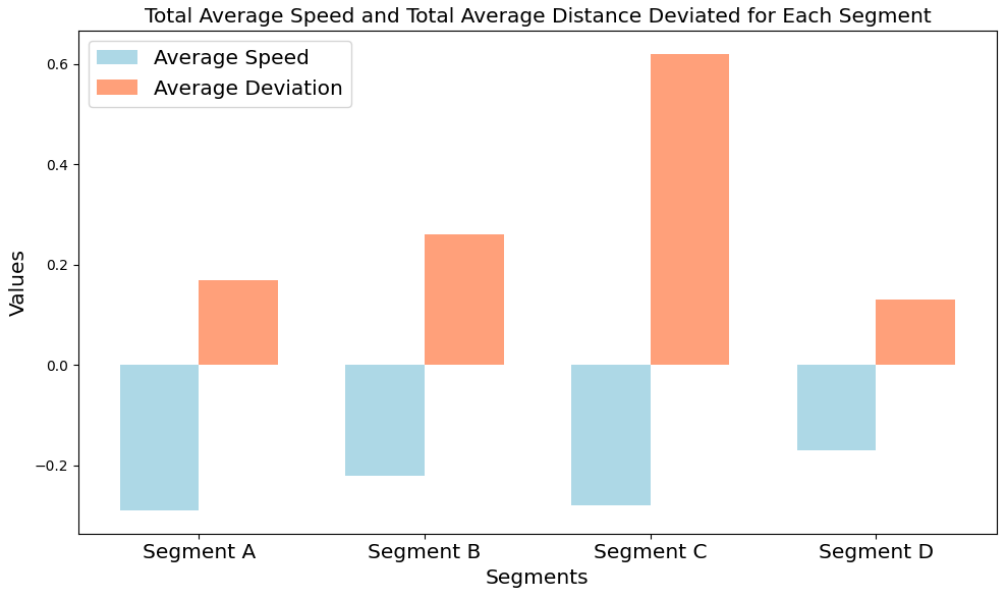

Figure 4.30 Summarized comparison of walking speed and position of all segments

Segment A stands out with the most negative average speed and segment C with the highest average distance deviation, indicating a significant shy distance from the desired path and potentially reflecting a high risk of pedestrian crash in this segment.

Based on this graph, we can now sort the segments based on their lateral position scores, helping us understand which areas are more prone to pedestrian accidents. Segment C stands out as the most vulnerable, with its notably higher lateral deviation scores indicating a greater risk of accidents. On the other hand, Segment D appears to be the least risky, showing relatively lower deviations in lateral position. This ranking offers valuable insights, enabling us to prioritize safety measures and interventions where they are most needed to ensure pedestrian safety.

4.3 Evaluating the extent of congestion caused by street begging

In this session, results are presented for each selected segment based on the data provided in objective one. Here, the congestion level is identified for each segment so that each segment is scored under their respective level of service.

4.3.1 Level of Congestion for Segment-A

The collected data and the recording date for this objective are the same as an objective one.

Street Width: 7 m

No of obstacles: Two (2)

Type of obstacles: Street vendors

Duration of pedestrian count: 15 min

Date of data retrieved: Feb 20, 2024 Morning 9:08 AM

For Baseline observation

HCM Model

In this model, to determine PLOS scores, pedestrian flow rates must be conducted. The pedestrian unit flow rate (ped/min/ft) is obtained by taking the pedestrian 15-minute flow rate (ped/15- min) and dividing it by the effective walkway width. Pedestrian counts were conducted for 3 minutes and later changed to 15 minutes. (Parma, K. D., Koprowski, Y., & Zhang, W., 2013).

PLOS = $\frac{P_{15}/15}{w}$ 860/15/7= 8.19 ……**HCM Grade C**

Table 4.14 HCM Grading Values

NO	HCM Grade	HCM flow rate (Ped/15/m)
1	A	Score ≤ 5
2	B	5 ≤ Score ≤ 7
3	C	7 ≤ Score ≤ 10
4	D	10 ≤ Score ≤ 15
5	E	15 ≤ Score ≤ 23
6	F	Score ≤

For Begging Intervention

No of obstacles: Two (2)

Type of obstacles: Street vendors

No of Beggars: Two (2)

PLOS = $\frac{P_{15}/15}{w}$ 910/15/7= 8.66 ……**HCM Grade C**

4.3.2 Summary of Scores and Grades of All Segments

Conducting the same procedure for all the segments, the following are the respective scores with their grade.

Table 4.15 Summary of Scores and Grades

	Segments	Street Width	No of pedestrians	Score	HCM Grade
Baseline observation	A	7	860	8.19	C
	B	9	1335	9.88	C
	C	3	665	14.7	D

	D	5	845	11.26	D
Begging Intervention	A	7	910	8.66	C
	B	9	1446	10.7	D
	C	3	691	15.3	E
	D	5	884	11.7	D

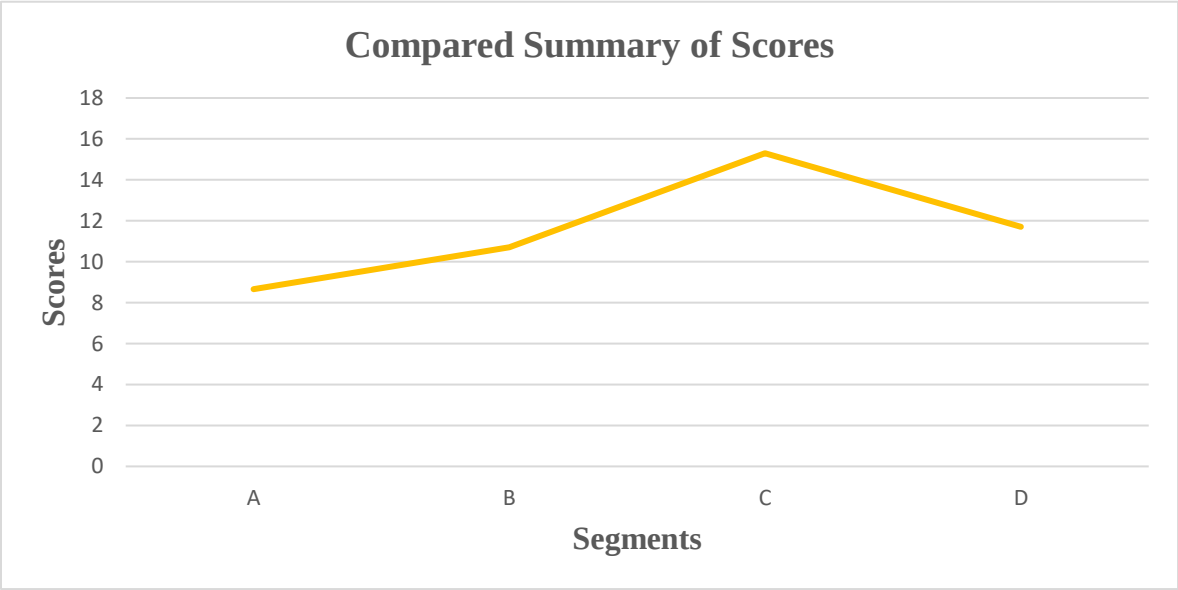

Figure 4.31 Summary of Scores

4.3.3 Discussion

In the baseline observation, Segment-A exhibited a PLOS score of 8.19, indicating a moderate level of congestion (Grade C), with a street width of 7 meters and 860 pedestrians. Interestingly, despite the intervention involving the presence of street vendors, the PLOS score slightly increased to 8.66, maintaining the Grade C classification.

Similarly, Segment-B experienced congestion under both conditions, with PLOS scores of 9.88 and 10.7 in the baseline observation and intervention phases, respectively. Despite a higher

number of pedestrians during the intervention (910 compared to 860), the slight increase in the PLOS score resulted in a change to grade D classification. This indicates that the intervention did not effectively address congestion in Segment B.

Segment C showed a notable increase in congestion levels with the intervention, moving from Grade D (11.26) to Grade E (15.3). Despite a small increase in the number of pedestrians from 665 to 691, the decrease in the PLOS score demonstrates the efficacy of the intervention in this segment.

Segment D, however, saw minimal change in congestion levels despite the intervention. Both scenarios resulted in Grade D classifications, with PLOS scores of 11.26 and 11.7 for baseline observation and intervention, respectively. This suggests that the intervention had a limited impact on congestion within Segment D.

The highest scored segment was segment C which indicates the most congested and the poorest level of service. Overall, while the intervention showed an increase in congestion in some segments, its effectiveness varied across different street widths and pedestrian volumes.

4.4 Safety problems faced by pedestrians

The following results are presented to assess the current safety problems faced by pedestrians on sidewalks. Questions are subdivided into 3sections. (See Appendix-A)

4.4.1 Gender Profile

As we can see from the table among the total number of respondents which is 384, almost half of the respondents 51.04% were females and 49.96 % respondents were males.

Table 4.16 Gender of Respondents

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	188	48.96	48.96	48.96
Female	196	51.04	51.04	100
Total	**384**	**100**	**100**	**100**

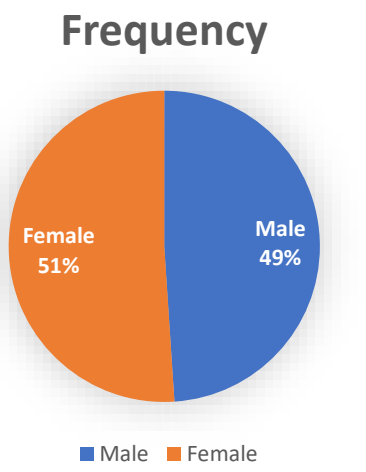

Figure 4.32 Sex frequency

4.4.2 Age Profile

Most of the data were collected from age groups 13- 29 and 30- 45 having a total percentage of 31.7 and 30.21 respectively. Of the whole respondents, the least participants are children only 27 respondents participated among 384.

Table 4.17 Age Profile

Age Group	Frequency	Percent	Valid Percent	Cumulative Percent
Under 18	27	7.03	7.03	7.03
18-25	122	31.77	31.77	38.8
26-35	116	30.21	30.21	69.01
36-45	80	20.83	20.83	89.84
46-55	39	10.16	10.16	100
56 and above	0	0	0	100
Total	**384**	**100**	**100**	**100**

4.4.3 Occupation

The majority of respondents were full-time employed. The distribution of respondents was as follows: 29.17% were full-time employed, 25.26% were students, 12.76% unemployed and others, 11.2% were self-employed and 8.85% were part-time employed.

Table 4.18 Occupation

Occupation	Frequency	Percent	Valid Percent	Cumulative Percent
Student	97	25.26	25.26	25.26
Employed (full-time)	112	29.17	29.17	54.43
Employed (part-time)	34	8.85	8.85	63.28
Self-employed	43	11.2	11.2	74.48
Unemployed	49	12.76	12.76	87.24
Other (please specify)	49	12.76	12.76	100
Total	**384**	**100**	**100**	**100**

4.4.4 Living or working duration

Most of the respondents have worked or lived for more than five years. The distribution of respondents was as follows: 25.78% for more than 5 years, 25.26% for 3-5 years, 21.88% for 1-3 years, 16.93% for 6-1 years and 10.16% for less than 6 months.

Table 4.19 Living or working duration

Duration	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 6 months	39	10.16	10.16	10.16
6 months to 1 year	65	16.93	16.93	27.08
1-3 years	84	21.88	21.88	48.96
3-5 years	97	25.26	25.26	74.22
More than 5 years	99	25.78	25.78	100
Total	**384**	**100**	**100**	**100**

4.4.5 Walking frequency on sidewalks

Most of the respondents walk daily on the sidewalks of Megenagna. 51.56% has the largest distribution.

Table 4.20 Walking frequency on sidewalks

Frequency	Frequency	Percent	Valid Percent	Cumulative Percent

Daily	198	51.56	51.56	51.56
Several times a week	99	25.78	25.78	77.34
Once a week	43	11.2	11.2	88.54
Rarely	28	7.29	7.29	95.83
Never	16	4.17	4.17	100
Total	**384**	**100**	**100**	**100**

4.4.6 Frequency of Encountering Street Beggars

"Daily" has the highest frequency with 225 respondents (58.59%) and "Never" has no respondents, resulting in a zero percent distribution.

Table 4.21 Frequency of Encounter

Encounter Frequency	Frequency	Percent	Valid Percent	Cumulative Percent
Daily	225	58.59	58.59	58.59
Several times a week	85	22.14	22.14	80.73
Once a week	34	8.85	8.85	89.58
Rarely	25	6.51	6.51	96.09
Never	0	0	0	100
Total	**384**	**100**	**100**	**100**

4.4.7 Types of street begging

Passive begging is the most frequently observed type, with 44.27% of respondents reporting it. Aggressive begging follows closely behind, reported by 38.54% of respondents. Begging with children or animals is observed by 29.17% of the respondents.

Table 4.22 Types of street begging

Types Observed	Frequency	Percent	Valid Percent	Cumulative Percent
Passive begging	170	44.27	44.27	44.27

Aggressive begging	148	38.54	38.54	82.81
Begging with children/animals	112	29.17	29.17	100
Total	**384**	**100**	**100**	**100**

4.4.8 Safety

The respondents were asked whether they felt unsafe because of street begging instances. Based on this, the frequency of "Yes" responses was 315, comprising 82.03% of the total respondents. Meanwhile, the frequency of "No" responses is 69, representing 17.97% of the total.

Table 4.23 Safety

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	315	82.03	82.03	82.03
No	69	17.97	17.97	100
Total	**384**	**100**	**100**	**100**

4.4.9 Type of safety

Physical safety is the most frequently mentioned concern, with 161 respondents (41.93%).

Table 4.24 Type of safety

Safety Types	Frequency	Percent	Valid Percent	Cumulative Percent
Physical safety	161	41.93	41.93	41.93
Emotional safety	12	3.13	3.13	45.06
Environmental safety	93	24.22	24.22	69.28
Traffic safety	44	11.46	11.46	80.74
Social safety	74	19.27	19.27	100
Total	**384**	**100**	**100**	**100**

4.4.10 Safety Problems

The most commonly reported issue is "Pedestrian pathways obstructed," with 189 respondents (49.22%) and the second largest reported issue is the presence of other criminal activities on sidewalks with 83 respondents. (85.15%).

Table 4.25 Safety Problems

Safety Problems	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian pathways obstructed	189	49.22	49.22	49.22
Verbal harassment or intimidation	11	2.86	2.86	52.08
Physical harassment or assault	24	6.25	6.25	58.33
Increased likelihood of accidents or collisions	20	5.21	5.21	63.54
Presence of other criminal activities	83	21.61	21.61	85.15
Exposure to unsanitary conditions	50	13.02	13.02	98.17
Fear of being followed or targeted	7	1.82	1.82	100
Other	0	0	0	100
Total	**384**	**100**	**100**	**100**

4.4.11 Impact on daily activities

Most of the respondents which are, 66.15% of respondents report avoiding certain areas or changing routes to address safety concerns.

Table 4.26 Impact on daily activities

Impact	Frequency	Percent	Valid Percent	Cumulative Percent

Feel anxious or stressed	81	21.09	21.09	21.09
Avoid certain areas or change routes	254	66.15	66.15	87.24
Feel less inclined to walk/use sidewalks	28	7.29	7.29	94.53
Experienced physical harm/injury	12	3.13	3.13	97.66
Witnessed harm/injury	3	0.78	0.78	98.44
No impact	6	1.56	1.56	100
Total	**384**	**100**	**100**	**100**

4.4.12 Discussion

The third objective investigated the safety concerns faced by pedestrians on sidewalks, segmented into several key aspects. The majority of respondents fall within the age groups of 13-29 and 30-45, reflecting a significant portion of the population likely to utilize sidewalks regularly, and the dominance of full-time employment among respondents suggests that many pedestrians might commute daily. The distribution across different durations indicates a mix of long-term residents and newcomers, each potentially experiencing safety concerns differently based on their familiarity with the area.

The predominant concern for physical safety, followed by environmental, emotional, traffic, and social safety, underscores the nature of safety perceptions among pedestrians. Emotional safety refers to feeling intimidated or harassed, environmental safety refers to concerns about cleanliness and hygiene, traffic safety refers to obstruction of pathways leading to accidents and social safety refers to feeling uncomfortable due to social interactions with beggars.

In general, the current safety problems faced by pedestrians on the sidewalk of Megenagna include physical and environmental safety, the presence of other criminal activities, changing

routes to avoid begging instances which leads to pedestrian crashes, lacking physical comfort due to aggressive begging

Efforts among stakeholders are necessary to develop targeted interventions that address specific safety issues identified in this study and ensure safety on sidewalks for all pedestrians.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study discusses the issue of street begging, which affects pedestrian movement and safety on sidewalks, particularly in urban environments like Addis Ababa. With beggars occupying valuable sidewalk space, pedestrians face congestion, delays, and increased vulnerability to accidents and criminal activities. The study aims to bridge this research gap by comprehensively examining how street begging impacts pedestrian mobility and safety, with the ultimate goal of informing evidence-based policies and interventions to enhance the pedestrian experience and safety in urban settings.

Through systematic observations and controlled interventions, the study seeks to isolate the impact of street begging on pedestrian movement by comparing data from periods with and without beggars present. Various data collection methods, including surveys and technological tools, were employed to gather insights into pedestrians' perceptions, experiences, and actual behavior in response to street begging.

The study examines the impact of street begging on pedestrian behavior across four segments (A, B, C, and D). In Segment A, the begging intervention caused decreased walking speeds and significant shifts in lateral position. Segment B showed similar trends with reduced speeds and noticeable lateral shifts in response to the intervention. Segment C, featuring a sidewalk along

an arterial road, exhibited lower speeds and wider lateral positions after the intervention, posing potential risks for pedestrian crashes. Finally, Segment D, reduced speeds and lateral shifts in response to the intervention, indicating altered pedestrian behavior compared to the baseline scenario.

On the level of congestion analysis, Segment A maintained a moderate congestion level (Grade C). Segment B experienced a slight increase in congestion (Grade D), Segment C exhibited a significant increase in congestion (Grade E), and Segment D showed minimal change in congestion levels, indicating the intervention's limited impact.

The assessment of pedestrian safety on Megenagna's sidewalks reveals several significant findings. Safety concerns primarily concerned physical safety, followed by environmental, emotional, traffic, and social safety. Issues such as obstruction of pedestrian pathways, criminal activities, and aggressive begging were highlighted as prominent safety concerns. Efforts among stakeholders are necessary to develop targeted interventions that address specific safety issues identified in this study and ensure safety on sidewalks for all pedestrians.

5.2 Recommendation

Recommendation to policies

- Street begging often arises from poverty and socioeconomic disparities. Effectively addressing this issue necessitates tackling the underlying problem of poverty through comprehensive, long-term interventions like economic empowerment programs, educational initiatives, social safety nets, and affordable housing projects. By uplifting individuals from poverty and fostering pathways to economic independence, the government, particularly the Ministry of Labour and Social Affairs can mitigate the prevalence of street begging.
- By enacting comprehensive anti-begging legislation, the government can establish a legal framework to address the complex issue of street begging and promote pedestrian safety. Since there is no enforcement regarding begging activities, it should strengthen enforcement of existing regulations in Ethiopia and introduce new legislation to address street begging and related activities. This could include penalties on aggressive begging

behavior, as well as implementing measures to restrict the presence of beggars in certain areas particularly megenagna to ensure pedestrian safety and mobility.

- The Ethiopian government should prioritize urban corridor sanitation as a means to discourage street begging and improve pedestrian movement and safety. This involves implementing measures to maintain cleanliness and hygiene in urban corridors, including sidewalks and public spaces where begging often occurs as well as exploring opportunities to create sustainable economic opportunities in sanitation and waste management sectors, providing employment and income-generating activities for individuals at risk of resorting to street begging.

Recommendation for planning and design

- By investing in urban infrastructure that prioritizes pedestrian comfort and engagement, such as introducing street furniture and altering the urban environment, cities can create environments that discourage street begging while nurturing vibrant public spaces.

- Megenagna stands out as one of the most densely populated and congested locales in Addis Ababa, largely due to its function as a primary public transportation hub. This concentration of people naturally attracts street beggars seeking alms. To alleviate and mitigate street begging, a proposed solution involves the design and implementation of an underground transportation center. Such a facility would not only mitigate pedestrian congestion but also reduce the prevalence of street begging activities in the area.

- Its recommended that all informal taxi and bus terminals to be dislocated into their own main terminal center so that congestion around every terminal decreases.

- Constructing open markets around the area aiming at providing employment opportunities for street beggars.

- Integrating various elements such as sidewalks, urban design principles, and road safety measures into a unified strategy aimed at improving sidewalk safety and overall urban mobility. Street begging instances can contribute to safety concerns on sidewalks, highlighting the need to address this issue as part of broader urban planning efforts. By

considering these various factors together, cities can create safer and more pedestrian-friendly environments, ultimately reducing the risk of accidents and conflicts between different modes of transportation.

Recommended Prototype Design for Segment C

- As indicated in the study's results section, Segment C exhibited the lowest walking speed score and the highest lateral position deviation, coupled with a high level of congestion. Therefore, a suitable solution is required for the segments as well as the other segments to ensure a smooth movement pattern and a safe sidewalk.
  The following strategies can be implemented:

Widening Sidewalks:

- Expanding the width of sidewalks can provide more space for pedestrians to move comfortably, reducing congestion and allowing for a smoother flow of foot traffic.

Removing Obstacles:

- Clearing unnecessary street furniture, signage, and other obstructions can help improve the directness of pedestrian paths and reduce lateral deviation.

Triangle Plaza:

- A triangle plaza is a small public space often created at the intersection of streets that form a triangular shape.
- These plazas serve as gathering spots, often featuring seating, landscaping, and sometimes public art. They help in calming traffic and providing a pleasant space for pedestrians.

Implementing Curb Bulbs or parklets:

- Curb bulbs, or 'curb extensions', are a strategy to extend the sidewalk into the parking lane at key locations. A curb bulb located at an intersection can shorten pedestrian crossings and improve safety by slowing down turning vehicles.
- A curb bulb can be also located midblock to provide a pedestrian crossing and is used to calm traffic by visually narrowing the roadway.

- In addition to improving safety, curb bulbs can provide a space for public amenities such as bike parking, transit stops, seating, and green infrastructure.

Improving Wayfinding:

- Clear and effective signage can help guide pedestrian movement, reducing confusion and unnecessary lateral deviation.

Benefits

- Enhanced Pedestrian Safety: Features like curb bulbs improve safety by reducing the crossing distance and making pedestrians more visible to drivers.
- Encouragement of Social Interaction: Outdoor seating and parklets create spaces for people to gather, rest, and interact, fostering a sense of community.
- Aesthetic Improvement: The addition of greenery and well-designed public spaces enhances the visual appeal of the urban environment.
- Traffic Calming: Elements like curb extensions and triangle plazas help slow down vehicular traffic, making the area safer for pedestrians
- Increased Utilization of Space: Parklets and outdoor seating make better use of urban space, providing amenities and attractions for residents and visitors.

Here is an improved recommended design of the sidewalk (Segment-C Road to Shola):

Top view for existing sidewalk layout

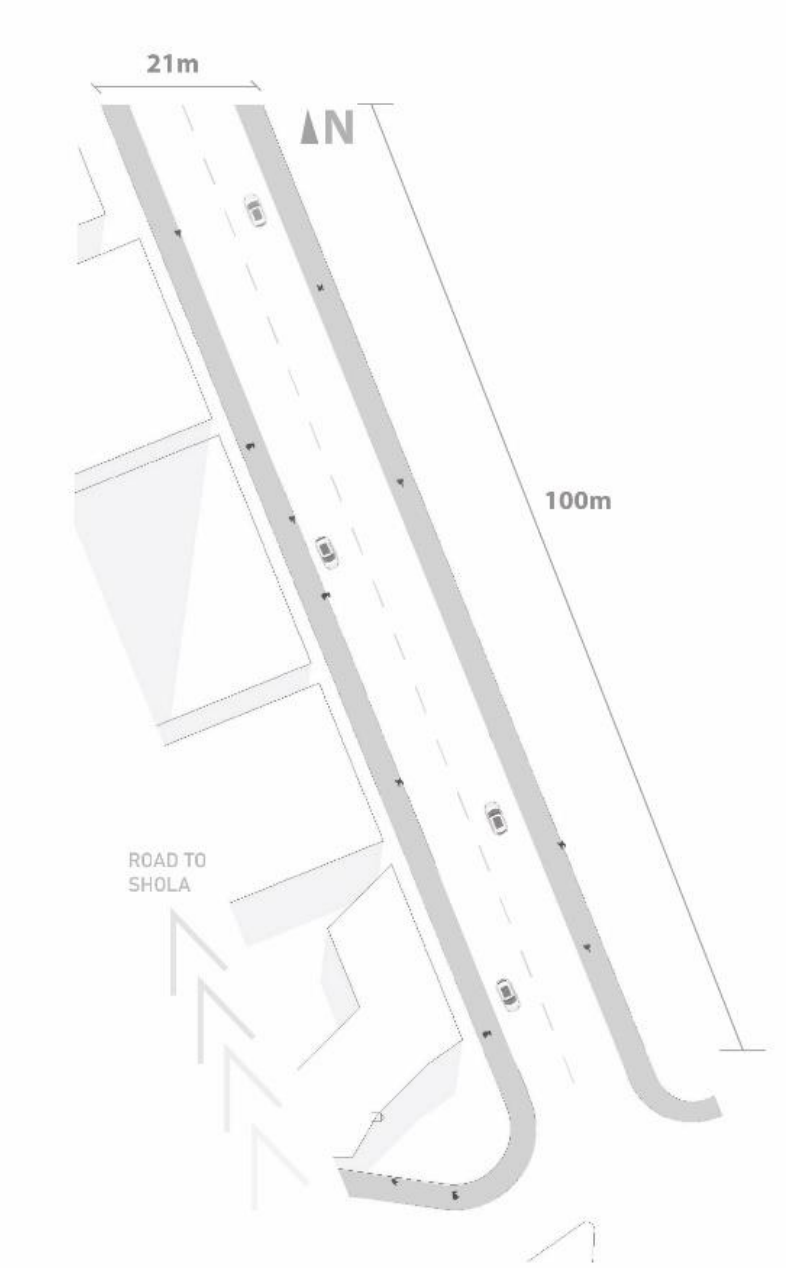

Figure 5.1 Top view for existing sidewalk layout

Top view for the improved sidewalk layout

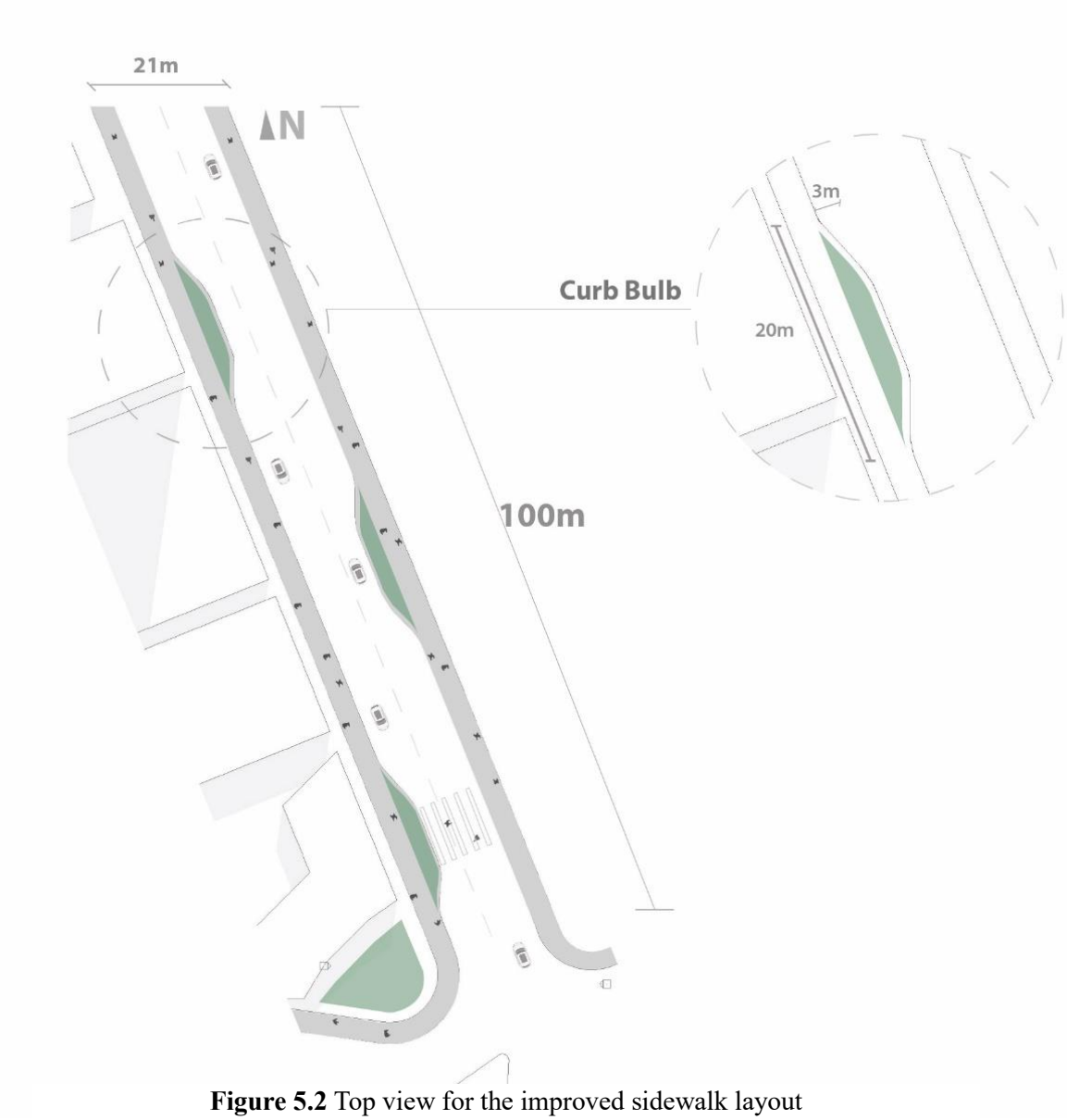

Figure 5.2 Top view for the improved sidewalk layout

The above figure illustrates a street design incorporating curb bulbs along a 100-meter stretch of roadway. Curb bulbs, also known as curb extensions, are shown at specific intervals along the street, designed to enhance pedestrian safety and improve the overall functionality of the urban environment. As pedestrians use the sidewalks effectively street begging activities are also disc

Isometric view for the improved sidewalk layout

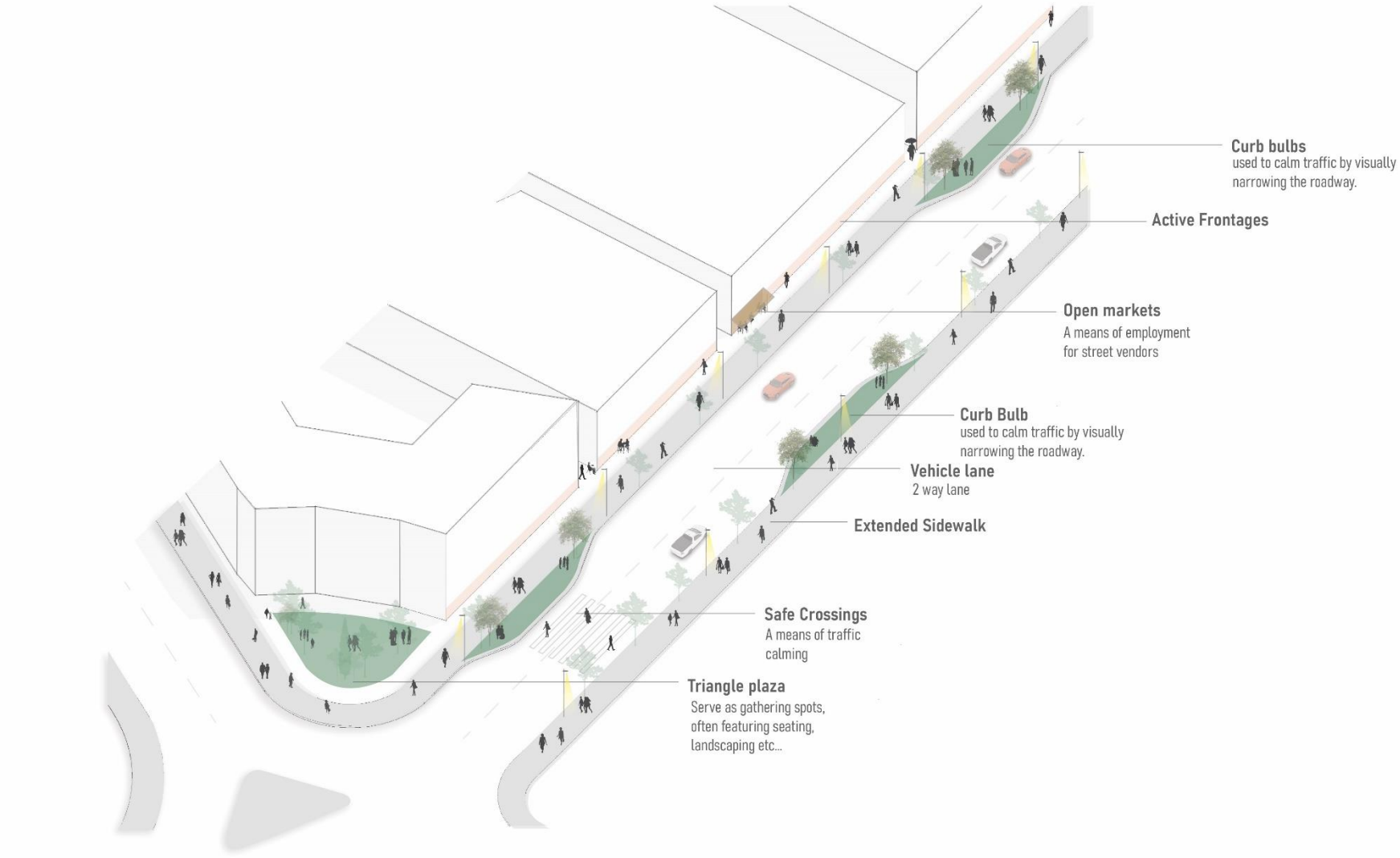

Figure 5.3 Isometric view for the improved sidewalk layout

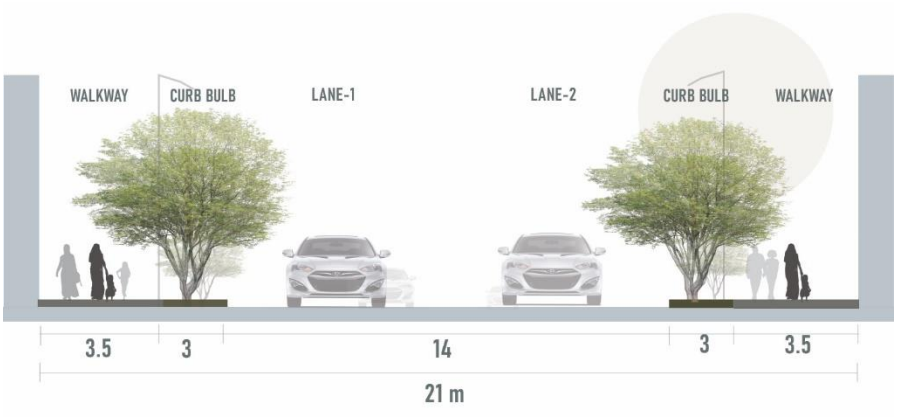

Figure 5.4 Street section for improved sidewalk

The figures above illustrate a comprehensive street design that incorporates several urban planning elements to enhance pedestrian safety and urban livability. key features include curb bulbs, which are used to calm traffic by visually narrowing the roadway, and extended sidewalks to provide ample space for pedestrian movement. Active frontages along the buildings engage pedestrians and foster economic activity.

The design also includes open markets, providing employment opportunities for street vendors, and a triangle plaza, which serves as a community gathering spot with seating and landscaping. Safe crossings are strategically placed to ensure pedestrian safety across the two-way vehicle lane. This integrated approach promotes a vibrant, safe, and accessible urban environment.

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APPENDIX-A

QUESTIONNAIRE

Adama science and technology university

school of civil engineering and architecture

Department of Urban Planning and Design MSc program

Dear respondent, thank you in advance for dedicating your time to participate in this questionnaire. Your contribution is invaluable and will greatly assist in my research for the fulfillment of my MSc in Urban Planning and Design.

Your honest responses to the closed-ended questions are crucial for the success of this study. Please feel free to provide your genuine feedback on all the questions.

Demographic Information:

1. Age:
    - Under 18
    - 18-25
    - 26-35
    - 36-45
    - 46-55
    - 56 and above
2. Gender:
    - Male
    - Female
    - Non-binary
    - Prefer not to say

3. Occupation:
    - Student
    - Employed (full-time)
    - Employed (part-time)
    - Self-employed
    - Unemployed
    - Other (please specify): [ ]
4. How long have you lived/worked in this area?
    - Less than 6 months
    - 6 months to 1 year
    - 1-3 years
    - 3-5 years
    - More than 5 years
5. How often do you walk on sidewalks in this area?
    - Daily
    - Several times a week
    - Once a week
    - Rarely
    - Never
6. How frequently do you encounter street beggars on the sidewalks?
    - Daily
    - Several times a week
    - Once a week
    - Rarely
    - Never
7. What types of street begging activities have you observed? (Check all that apply)
    - Passive begging (sitting/standing with a sign)
    - Aggressive begging (approaching pedestrians, demanding money)
    - Begging accompanied by children or animals
    - Other (please specify): [ ]

8. Have you ever felt unsafe due to street begging activities on the sidewalks?
    - Yes
    - No
9. Please indicate which safety types you associate with street begging activities on sidewalks. (Check all that apply)
    - Physical safety (e.g., fear of assault or violence)
    - Emotional safety (e.g., feeling intimidated or harassed)
    - Environmental safety (e.g., concerns about cleanliness and hygiene)
    - Traffic safety (e.g., obstruction of pathways leading to accidents)
    - Social safety (e.g., feeling uncomfortable due to social interactions with beggars)
    - Other (please specify): [ ]
10. In your opinion, what are the main safety problems caused by street begging activities on sidewalks? (Check all that apply)
    - Pedestrian pathways obstructed
    - Verbal harassment or intimidation
    - Physical harassment or assault
    - Increased likelihood of accidents or collisions
    - Presence of other criminal activities (e.g., theft, drug use)
    - Exposure to unsanitary conditions (e.g., discarded needles, waste)
    - Fear of being followed or targeted
    - Other (please specify): [ ]
11. How do these safety problems affect your daily activities or routines? (Check all that apply)
    - I feel anxious or stressed while walking on sidewalks
    - I avoid certain areas or change my route to avoid beggars
    - I feel less inclined to walk or use sidewalks
    - I have experienced physical harm or injury
    - I have witnessed others experiencing harm or injury
    - These safety problems do not impact my daily activities or routines